The Effect Of Scaffolding On The Acquisition Of Rowing

Thesis

The Effect of Scaffolding on the Acquisition of Rowing

Salih Hassan P5675820 Doctor of Education (EdD) 2003

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Abstract

The aim of this thesis is to examine the nature of scaffolding in learning to row. Four studies were carried out to investigate the nature of instruction in relation to learning to row. Study 1 investigated the relationship between contingent tutoring and learning to row. Contingency tutoring was significantly related to learning to row. The coaches in this study were coaching individual boys on a one-to-one basis, in a single environment. Study 2, tried to replicate study 1, with the introduction of three other learning environments: the 'ergometer', the 'rowing tank'and the rowing boat. Unlike study 1, this study found a negative relationship between scaffolding and learning to row. There were also differences between the environments. It was therefore, necessary to conduct a further study.

Study 3 was an observational study, designed to examine the nature of coaching itself. It found that, most of the coaching activity was based on generalised instructions, with only 8% of the time employing scaffolding techniques. Grouped-based instruction made up 26% of the instruction, while individual instruction made up 33%; the coach simply observed for the rest of the time. The study found differences between the environments, in terms of the amount spent on each coaching activity. Contingent tutoring varied according to the environment in which the instruction was given.

Study 4 interviewed 10 coaches about their coaching. It found strong evidence of the coaches using the functions of scaffolding. The coaches also adopted different coaching strategies, based on the different learning environments, the time of the session, physical state of the boys and the physical state of the river. The theoretical, practical and methodological implications of these findings are then discussed.

This thesis found that the 'learning environment' had a large impact on the nature of teaching and learning to row. Each 'learning environment' required a different approach to teaching/coaching, which in turn produced different responses from the learners'.

Chapter 1: Introduction

1.1 Rationale for the Thesis

As a practising teacher and international oarsman, I am very interested in the effectiveness of how teaching and learning can best be facilitated while coaching crews on the river. The ultimate aim is to give the crews responsibility to coach and direct themselves with little intervention from the coach. It is hoped that over time, the crews will train on their own and to develop the skills to assess their progress. The aim of this study is to investigate the effect of contingent tutoring on the acquisition of rowing among 13-14 year old boys.

This thesis argues that different 'learning environments' require different approaches to teaching/coaching of rowing, thus producing particular responses in relation to the instructions given. The three 'learning environments' in which rowing takes place; the 'rowing tank' and 'the ergometer', which are land based activities and the rowing boat. Each 'learning environment' requires different skills from the learner and the coach must recognise the nature of instruction given, in order for those skills to be useful and efficient.

1.2 Summary of the thesis

This section provides an overview of the thesis. The aim is of this thesis to investigate the role of scaffolding in learning to row.

Research investigating scaffolding in learning and education is reviewed in chapter 2. It first discusses the theoretical underpinnings of scaffolding and then reviews studies on scaffolding. These can be split into four main research areas, dealing with studies of scaffolding from different perspectives.

The first group of studies looks at the correlation between parents' teaching behaviour and the child's subsequent individual performance. These studies show a strong relationship between mothers teaching behaviour and later performance of the child. The best results are achieved by those mothers tailoring their scaffolding to the child's needs by giving guidance at a level that is near the limits of the child's performance.

The second group of studies examines experimental approaches to scaffolding. Wood, Wood and Middleton (1978) reported an experimental study where researcher/teacher assisted three-year-old children using different strategies from a mother-child interaction. They used a 'contingent approach' and a 'verbal approach'.

They found that contingently taught children, significantly outperformed those that were not contingently taught. These findings were replicated by Pacifici and Bearison (1991). Day and Cordon (1993) Pratt and Savoy-Levine (1998).

These studies experimentally investigated the effects of scaffolding, and have consistently found that that those children taught in a one-to-one situation, using the principles of scaffolding, did better than those children taught by other methods.

The third group of studies look at large scale teaching interventions. These interventions are based on the principles of scaffolding. However, unlike the other studies above that were based on one-to-one interactions, these studies by their nature have developed strategies, which are grouped based. Brown et al (1986), looked at what they call 'reciprocal teaching', which was designed to provide an introduction to group discussion techniques aimed at understanding and remembering text context.

Reciprocal teaching was designed on Vygotsky's idea of ZPD within which the learner could gradually take on greater responsibility for their learning. Brown (1986) found that the procedure very successful as a reading and listening comprehension intervention by classroom teachers with academically 'at risk' children.

The authors found that the technique transferred responsibility from the adult to the child. A second large scale teaching intervention based on scaffolding is the Kamehameha Elementary Education Programme (KEEP) in Hawaii. KEEP was developed by Tharpe and Galimore (1988). It is based on Vygotsky's principles of the ZPD. It was a ten year project aimed at helping children 'at risk' and it found that children were able to have greater control of tasks with the help of their teachers. The teachers used scaffolding procedures and the study found that responsibility for completing tasks were soon passed to the children. Reading Recovery is another teaching intervention programme based on scaffolding principles. Hobsbaum et al (1991), looked at scaffolding in Reading Recovery, which is a one-to-one intervention (other studies looked at groups) for children having difficulty reading after a year at school. Hobsbaum and her colleagues found scaffolding useful. Large scale teaching interventions studies found substantial benefits from using scaffolding techniques in teaching situations.

Observational studies make up the fourth and final group of investigations. Greenfield and her colleagues (1984) observed how scaffolding worked in informal education, when girls in Guatemala learned to weave.

Both Fleer (1992) and Maybin et al. (1991) observed that scaffolding was observed in a classroom situation. Saxe et al (1987) demonstrated that adults did serve as competent teachers and observed scaffolding. Rogoff et al (1990) examined how toddlers and their caregivers from four cultural communities collaborate in shared activities. The authors found that there were important common features and differences in the processes of guided participation in varying cultural communities.

Chapter 2 reviewed correlational, experimental and large scale teaching interventions. They all showed that scaffolded instruction was effective across a wide range of ages and activities. However, these studies tended to focus on formal settings with young children in a one-to-one interaction situation or small group situation. The aim of this study is to investigate scaffolding in a group situation and in an informal setting: learning to row.

Chapter 3 reports an initial investigation into the role of scaffolding in learning to row. The first aim of the study was simply to investigate whether rowing coaches were employing scaffolding in an informal group based coaching situations. The second aim was to investigate whether the region of sensitivity (i.e. level of instruction) would be higher in the earlier instruction sessions than in the later sessions. The third aim was to examine whether there was a negative relationship between the region of sensitivity and the boys' initial level of ability. The fourth and final aim was to investigate whether there was a positive relationship between learning to row and scaffolding. The study investigated 13 to 14 year old boys (n = 12) learning to row in two groups of 6. The boys were from an independent school in South West London, from essentially middle-class families. All the boys volunteered to take part in this study.

There were five sessions in total, with a pre-test at the start and a post-test at the end of the coaching sessions. Sessions 1 and sessions 5 were video taped and analysed to measure the effectiveness of 'contingent' tutoring and the level of scaffolding.
The study specifically looked at certain aspects of the rowing stroke, which were the 'recovery', 'catch', 'drive' and 'release'.

The study found that for the coach, the proportion of teaching interventions that were contingent ranged between 14% to 67% and the proportion of interventions that were in the region of sensitivity ranged between 25% and 67%. The boys improved between the pre and post-test. They also improved over the five sessions this was reflected in the coaching. The coaches used fewer explicit instructions in the last session compared to the first session. There was also a positive relationship between the proportion of coaching interventions that were contingent and pre- to post-test improvement in some of the elements of the stroke. Thus, this study found that scaffolding was a useful teaching method used in the activity of learning to row. Contingency of the coaching instruction was a good predictor of how well the boys learnt to row. These findings are consistent to the findings reported by Wood and his colleagues. Study 1 was a preliminary investigation into learning to row and scaffolding.

It found that the coaches did use scaffolding and that it was related to learning to row. However, like Wood and Middleton's study, this looked at a single environment with a small group of novice boys.

Chapter 4 reports a study, which is a replication and extension of the study reported in chapter 3. The first aim was to replicate the first study and examine whether the coaches were using scaffolding. The second aim was to examine whether there was a relationship between scaffolding and learning to row. The third aim is to investigate whether there is a negative relationship between the Region of Sensitivity and the boys' initial level of ability. The fourth aim was to examine whether scaffolding was dependent on the environment. The three learning environments range from the 'ergometer' and rowing 'tank' (land based activities) to the rowing boat (river based). These are essentially informal, naturalistic environments consisting of sixteen boys and three coaches. The boys' were aged between 13-14 years from middle class families in SW London. All the sessions were videotaped and they all volunteered and agreed to be filmed.
The boys were given a pre-test and a post-test on the four basic elements of the rowing stroke.

These are 'recovery', 'catch', 'drive' and 'release', and each boy was given a score between 1-10 on both tests. After the pre-test, there were three weeks of normal coaching and training of 1-2 hours each, followed immediately by the post-test.

The study found like the first study that the coaches employed scaffolding. The number of interventions per session ranged from 32-57 and the percentage of interventions with the region of sensitivity ranged from 44.1-63.1 and the percentage of interventions that were contingent ranged from 35.8-47.3. The study also showed as predicted and replicating study 1 that the region of sensitivity from the pre-test to the post-test shifted from levels 3-4 to levels 1-2. This indicated that the coach was using less explicit instructions as the boys improved.

However, unlike Study 1 this study found a negative relationship between the proportion of scaffolding and learning to row.

This study found that the different environments differed in terms of the amount of contingent tutoring and the amount in the region of sensitivity. The impact of the 'learning environment' on the nature of teaching and learning to row became more apparent when the 'tank', 'ergometer' and the rowing boat were looked at in more detail. Wood et al (1975) did not take into account the impact of multi-environments and the number individuals within the group.

Because it did not find scaffolding related to learning to row, it was decided to conduct another study to investigate the use of different coaching and not just scaffolding.

Chapter 5 is an observational study of coaching rowing. The first aim was to examine the coaching activity in coaching rowing. The study will investigate the different types of coaching employed and how often scaffolding is used in a coaching setting. The second aim was to compare the coaching style of different types of coaches. The third aim was to examine whether the type of coaching was dependent on the learning environment.

The study employed sixteen boys aged 13-14 years from middle class families in SW London. The two coaches are employed by their school; one is a classroom teacher (Coach A) who coaches, while the other coach (Coach B) is just employed to coach. The boys were seen individually and collectively in a crew and the sessions were videotaped.

The first two sessions were on the 'tank', the next two sessions were on the 'ergo' and the final two sessions were on the river in a boat. The three learning environments were videotaped and lasted for about 1-2 hours.

Most of the coaching activity was spent making general instructions, , while only 8% of the time was the coach employing scaffolding techniques. Most of the specific instructions were made to individual boys 53 of 57 interventions. There were only 14 incidences of scaffolding that took place. A number of significant differences in coaching were found between the coaches. As for the coaches themselves, Coach A executed more general encouragement.

Coach B, produced more specific instructions, with little difference of the amount of demonstration between them. There were differences between them in terms of the activities used in coaching. There were a number of differences between the three environments in terms of the amount of time spent on each coaching activity. There was twice as much time spent on specific instructions on the river, compared to the 'tank' and 'ergo'. Similarly, there was more time spent on observation on the river (3:1), than on the 'tank' and the 'ergo'. There was also twice as much time, spent scaffolding on the river than on any other environment. There were differences in the number of coaching interventions and the different learning environments. The coaches were focusing on individuals within a group, which makes scaffolding difficult to observe. Much of the coaching involved making general comments to individual boys within a large group in an informal and naturalistic setting. Can scaffolding be adequately explained by Wood's original definition? Perhaps a re-defined notion of scaffolding would be required to explain scaffolding in multiple environments. Study 3 found that scaffolding was a very small part of coaching and that the coaches employed different strategies. It was therefore necessary to conduct a further study, to investigate these different strategies.

Chapter 6 is an interview study, examining coaches and their use of different environments. Study 4 was designed to investigate further the different coaching strategies used and why they were used. It was felt that an interview study was best suited to extract the information needed to address the impact of 'learning environments' on the nature of teaching and learning to row, and what the coaches had on their mind when they instructed their crews. No previous study had looked at coaching/teaching, groups of boys in multi-learning environment.

The first aim was to examine coaching strategies. It investigates different types of coaching employed and how often scaffolding was used in the coaching settings. The second aim was to examine whether the coaching strategy of the coach was dependent on the learning environment. The third aim was to examine whether the type coaching was dependent on the learning environment.

There were five coaches and five teachers (who coach), who were interviewed. The interviews lasted between 30-45 minutes and usually took place at their respective boathouse and usually after their outing. The interviews were hand written, with twenty-five questions, structured in three parts. The first part was simply gathering background information, the second part was related to coaching strategies and the third part were related to the coaching environment.

The time spent coaching, ranged from 1-14 years, averaging 7.1 years. The coaching age range shifted from 14 year olds to competent adult crews, with most of the coaches rowed to a high standard themselves. All the coaches live and work in Surrey; all the teachers have a degree and a PGCE, while the coaches do not have formal qualifications. The responses from the interviews were analysed in terms of the 'functions' of scaffolding. The answers to the questions were also analysed for evidence of contingency.

There was evidence that all the coaches used the functions of scaffolding. The first function of recruitment was mentioned in terms of making the sessions fun and relaxing. The second function, reduction in the degrees of freedom, was mentioned in terms of the way the coach used different boats according to the river conditions, by getting half the crew to balance the boat, while the other half rowed, and by using the wall in the rowing tank to stop the boys' oars from going too deep. Marking critical features was employed by using particular exercises and videotapes to stress key aspects of the stroke. The final function of scaffolding, demonstration and modelling was apparent in many of their comments. There was also evidence of the use of contingency by the coaches. The coaches demonstrated how they would adjust their interventions depending on the success or failure of their instructions. They also pointed out how the nature of the environment allowed them to coach in a particular way. Water conditions were very important to the design of their outing.

There were differences in the learning environments and the time spent on each activity. Much of the coaching took place on the river, compared to the 'tank' and the 'ergo'. Twice as much specific individual coaching took place on the river than the 'ergo' and the 'tank'. Most of the general coaching took place on the 'tank', while demonstration took place on the 'tank' as well as the 'ergo'.

General observation was mainly used when coaching on the river. This is expected, since rowing is largely river based. There were also differences in coaching strategies. The teachers were largely classroom based, while the coaches were employed purely to coach rowing. They were seen as the 'professionals', while the teachers had a subject to teach.

Chapter 6 found that the functions of scaffolding were widely used during every coaching session. These functions were more commonly used than had previously thought. Contingency was also used, but this study extended Wood's notion of the two 'rules' (success and failure).

Chapter 6 argues that the notion of scaffolding is more subtle than this; it depends on other factors, such as the amount of time available for each session, the physical and mental state of the boys during the sessions and whether or not the crew had a good outing prior to the interview. All these factors were dependent on the river conditions and the time of year. These additional contingent factors were crucial to understanding the nature of instructional activity and to the development of the learner.

Chapter 7 is the conclusion chapter and will outline the main achievements of the theses, the implications for practice and implications for research. Further research on this issue will also be outlined.

Chapter 2: Review of the Research on Scaffolding

2.1 Introduction

This chapter will review, research investigating scaffolding in learning and education. It first discusses the theoretical underpinnings of scaffolding. In the chapter, three theoretical frameworks are compared: David Wood' s theory of scaffolding; Tharp & Gallimore's theory of assisted performance and Barbara Rogoff's theory of guided participation. Similarities and differences between these three theories are discussed. The next sections report research on scaffolding. These can be split into four main methods. The first group of studies looks at the correlation between parents' teaching behaviour and the child's subsequent individual performance. These studies show a strong relationship between mothers' teaching behaviour and later performance of the child. The second group of studies examines experimental approaches to scaffolding. These studies experimentally investigated the effects of scaffolding, and have consistently found that that those children taught in a one-to-one situation, using the principles of scaffolding, did better than those children taught by other methods. The third group of studies, looked at large scale teaching interventions. These interventions are based on the principles of scaffolding. However, unlike the other studies above that were based on one-to-one interactions, these studies by their nature have developed strategies which were based groups.

Large scale teaching interventions studies found substantial benefits from using scaffolding techniques in teaching situations. The fourth and final groups of investigations are observational studies. Most of the studies involving one to one interaction or small group interaction have found evidence of scaffolding however studies of whole class interaction have found little evidence of scaffolding. This chapter finishes by looking at some common criticism of scaffolding and critically reviews the methodologies employed to study scaffolding. The thesis concludes that it will use a combination of participant observation and interview studies to study the incidence and effects of scaffolding on children learning to row.

2.2 Scaffolding

There are numerous in which teachers transmit knowledge to the learner. Wood (1986) argues that if we can identify the crucial features of effective teaching, then it would be possible to examine teaching styles. He continues to say that children who do well after instruction are those who are instructed by tutors most likely to act according to two 'rules' of teaching. The first dictates that any failure by the child to carry out an action after a given level of control should be met by an immediate increase in help or control. Secondly, this concerns the 'rule' of what should happen when a child succeeds in complying with an instruction. This dictates that any following instruction should offer less help than which pre-dated success, which allows the child more room for success, and of course, error. The types of responses by the teacher to a child's momentary success and failures are judged in relation to the instruction given.

Therefore, every time a teacher acts in accordance with the 'rules', s/he is considered to have made a contingent response (Wood 1986). Every time s/he does something different, the instruction is non-contingent. It follows then that the more frequently contingent the teacher is, the more the child can do alone after instruction. Wood (1986) strongly argues that the process of effective instruction is the contingent control of learning.

Scaffolding is used to describe the ideal role of the teacher. Bruner (1976) and Wood (1986) argue that individuals can only take so much information about their situation at any moment in time, so they must organise their activities over time in order assimilate and operate within that situation. Wood (1986) in particular argues that the notion of 'uncertainty' is central to the concept of human abilities. He continues to say that when we find ourselves in an unfamiliar situation, uncertainty is high and our capacity to attend to and remember objects and features within that situation is extremely limited. The reduction of uncertainty is paramount because accompanying this is increased accuracy of perception and memory. Without assisted help, children may be overwhelmed by uncertainty; therefore the more knowledgeable can assist them, thus reducing this uncertainty.

Wood et al (1976) introduced the notion of scaffolding in the context of tutorial interaction between the adult or 'expert' and a child or less expert. This notion was designed to explore the nature of support that the adult/expert provides in helping a child/less expert to learn how to perform a task that, alone, the child/less expert could not master. Parallels between the notion of scaffolding and Vygotsky's more general theoretical concept of 'Zone of Proximal Development' (ZPD) were soon drawn.

The general Vygotskian view (Wertsch, 1979) is that cognitive development does not occur in isolation, but involves the helping role of culture through immediate care-givers, who promote the child's development of further capacities by assisting the performance of actions of which s/he is not yet capable on their own. Here Vygotsky calls on the idea of a zone of proximal development (ZPD), which is characterised as the difference between what a child can do on their own and what s/he can do with expert assistance. Vygotsky's view of development is that constantly upgraded assistance keeps the child moving forward in terms of cognitive functions which s/he gradually appropriates or internalises, so that these functions can now be done by the child on his or her own.

Extending and testing these ideas in empirical work, Bruner and Wood in particular have coined the term scaffolding to indicate the contingent nature of the assistance which seems to be required in order to lead to independent capacities on the part of the child. Whilst this Neo-Vygotskian perspective does emphasise the role of the environment and of the social context, it sees an active role for the child as cognitive operator, not a merely passive one.

2.2.1 Characteristics of Scaffolding

As described earlier, scaffolding is a form of helping process and it could be differentiated from mere immediate assistance in that it involves both adult and child interacting towards the solution of the task, rather than mainly the adult completing the task and explaining it to the child or the child passively observing the adult and extracting relevant information spontaneously. According to Wood, Bruner & Ross (1976) scaffolding help is characterised by five features:

Recruitment – Getting the students interest
Reduction in the degrees of freedom – This involves simplifying the task
Direction maintenance – Keeping them in pursuit of a particular objective
Marking critical features – marking certain features of the task that are relevant
Frustration control – Making the activity less stressful
Demonstration and Modelling – Modelling solutions of a task. Providing idealisation of the act.

Wood also characterises scaffolding as contingent and acting within the region of sensitivity. Wood argues that scaffolding is the contingent nature of assistance, which leads to the independent capacity if the child. The idea in rowing is that as the 'crew' develops, it will be able to 'coach' and instruct itself. The 'crew' will be capable of sorting out problems and deciding the course of action needed to solve them.

2.2.2 Contingent instruction

Wood (1975,1978, 1986, 1996) outlines three ways instruction can be contingent. Originally, he only talked about the instructional contingency but later Wood (1996) talked about domain contingency and temporal contingency.

i) Instructional contingency

Wood (1986) argues that when a tutor is being instructionally contingent when they act according to 'two rules' of teaching.

The first rule dictates that any failure by the child to carry out an action after a given level of control should be met by an immediate increase in help or control. Secondly, what happened when the child succeeds? This implies that less help will be given to the child to allow more freedom of success. The important criteria here, is how the teacher responds to the child's momentary success or failure judged after the given instruction. Thus, each time the teacher acts in accordance with the rules, they are considered to have made a contingent response.

ii) Domain Contingency,

Domain contingency involves decisions about what to teach next in response to local circumstances. For example when the tutor has suggested one approach to a problem, and the learner does not follow the instruction but does something else.

This action by the student is a perfectly sensible way of proceeding; their own means to the tasks end. The domain contingent tutor should suspend their own initial teaching intent and offer any subsequent help in relation to what the learner is inferred to be trying to do. It involves decisions about what to teach next in response to local circumstances. The tutor is contingent on the child's model rather than his/her own.

iii) Temporal Contingency

Temporal contingency is concerned with the timing of the instructional intervention. It refers to the need to time any instruction to fit the flow of the learner's activity. David Wood and Heather Wood (1996) observed tutoring and communicating between adult and deaf children, and found that the timing of instruction can create problems in the maintenance of mutual understanding

2.2.3 The Region of Sensitivity

The region of sensitivity as outlined by Wood and Middleton (1975) is also an important concept to consider. This is a hypothetical measure of the child's current task ability and his 'readiness' for different types of instruction.

Although effective instruction requires the child to do more than he is immediately capable of, it must not ask him too much. Ideally, the child should be asked to add one extra operation or decision to those, which he is currently doing. Wood et al.(1987) argue that effective instruction will concentrate within this boundary.

Scaffolding and contingency are teaching roles; that is, how the teacher responds to the needs of the child after an instruction has been given. What does the teacher do after the child has carried out the instruction? The adult/teacher is seen as the expert; the child is the novice that requires help. There is little about the child taking control or changing the adult's response in Wood's earlier work. However, his later work begins to see the child not as a passive observer, but as taking more control in directing his/her learning. The region of sensitivity is the hypothetical measure the adult/teacher needs to be aware of to introduce the next step in the learning process. This is where effective instructions need to be focussed on to achieve the greatest development.

2.3 Assisted Performance

Another closely related theory is the theory of assisted performance by Tharp & Gallimore (1988).They argue that pupils/students cannot be left to learn on their own and that responsive, assisting instructions must become common place in the classroom. What the authors mean, is that interactions must begin with the child's current level of understanding, consequently to allow the child a meaningful role in the setting of the instructional task or goal. Assisted performance also includes helping behaviours by the teacher that assist the pupil to pursue these goals and move from one level to the next; and finally by pulling performance from the child so a productive communication or creation by the child is the vehicle for instantiating new knowledge. When the teacher assists performance in this way, they are clearly responsive to the students' previously existing knowledge base or performance capacity and remain responsive to advances in the students' capacities. These work together responsively and flexibly to reach instructional goals. The responsive teacher takes a route towards these goals that is drawn in collaboration with the child and is responsive to the child's emerging capacities.

In Vygotskian terms, teaching is good only when it 'awakens and raises to life those functions that are in a stage of maturing, that lie in the zone of proximal development' (Vygotsky, 1956). So what is teaching? Teaching consists in assisting performance through the ZPD. Teaching occurs when assistance is offered at points in the ZPD, where performance requires assistance. Teaching becomes assisted performance and occurs when this performance is achieved with assistance.

Hence, teaching is not only assessing learners, but assisting them. The authors argue that there are seven means of assisting performance and facilitating learning. They continue to say that these methods are effective and dependable measures. These include:

Modelling: offering behaviour for imitation. Modelling assists by giving the learner information and a remembered image that can serve as a performance standard.
Feedback: the process of providing information on a performance as it compares to a standard. This is essential in assisting performance because it allows the performance to be compared to the standard and thus allows self- correction.

Contingency management: application of the principles of reinforcement and punishment to behaviours.

Instructing: requesting specific action. It assists by selecting the correct response and by providing clarity, information and decision-making. It is useful when the learner can only perform part of the task, thus requiring more help.

Questioning: a request for a verbal response that assists by providing a mental operation, the learner cannot or would not produce alone. This also gives the teacher more information about the learner's understanding of the task.

Cognitive structuring: 'explanations'. This structuring assists by providing explanatory and belief structures that organise and justify new learning and perceptions, that allow the creation of new or modified schemata.

Task structuring: chunking, sequencing or otherwise structuring a task into or from components. It assists the learner by modifying the task itself, so the units presented to the learner fit into the ZPD when the entire instructional task is beyond that zone.

When all these features are interacting, that is, the goal of the teacher is to bring the performance of the learner through the ZPD into the independent capacity, and when the assistance is woven into a meaningful dialogue during joint activity, there exists the 'instructional conversation'. The novice oarsman cannot be left on their own to get on with the task, that responding and assisting with instructions are essential for any progress to be made. The coach needs to be sensitive to the requirements of the novice and help as much as possible, until they are able to carry out the task on their own.

2.4 Guided Participation

The third theory, which is also closely related to scaffolding is Barbara Rogoff's (1986, 1990, & 1991) theory of guided participation. In this theory she identifies a number of processes involved in guided participation.

i) Providing Bridges from the known to the new

The first process is providing brides from the known to the new. Adults serve to provide a bridge between a learner's existing knowledge and skills and the demands of the new task. She argues that, left alone, a novice might not appreciate the relations between what the task needs and what they already know or can do that is relevant.

ii) Choosing and structuring the activities

The second process is through choosing and structuring the activities. Rogoff argues that probably the greatest influence of the social world is choosing the activities that are available to children for observation and participation.

Adults also structure the situations to allow children or novices to participate. For example Rogoff mentions an interesting study by Burton, Brown & Fisher (1984). They carried out a study of an extremely complex skiing, to determine why it has become so easy to learn. Their goal was to analyse the features of a highly successful learning environment in order to articulate the general theory of learning environments.

They argue that learning environments can be examined in terms of a paradigm called 'increasing complex micro-worlds' (ICM). In this paradigm, the student is exposed to a sequence of environments (micro-worlds) in which his task becomes increasingly complex.

The purpose of an individual micro-world is to provide the student with a task that he can perform successfully using a simplified version of the final skill in the goal. This allows the student to focus on and master one aspect of the skill in a context that requires related sub-skills. As a result, the student learns when to use the skill as well as how to use it. The purpose of the sequence, they argue, is to evolve the simplified skills towards the goal skill. The ICM framework focuses both on what is learned in any particular micro world and on how to choose the next micro world in the sequence.

Burton et al (1984) argue that micro worlds are created by manipulating three elements: the equipment used in executing the skill, the physical setting in which the skill is executed, the specifications for the given equipment and physical setting.

They believe that these three manipulations allow the students to focus on the factors that are fundamental to learning a skill, rather than on factors that are not immediately relevant.

iii) Transfer of Responsibility

The final process in Rogoff's theory of guided participation is the transfer of responsibility. Here Rogoff explicitly uses Wood's theory of scaffolding to show how adults support children's learning and allow children to take on more responsibility for managing the situation.

This is an important point, since both Wood and Rogoff argue that the child/novice is given responsibility for managing their own situation. In rowing the 'crew' develops and begins to coach its self. This 'crew' becomes more critical and finds other ways of solving technical problems, thus allowing more autonomy to make decisions.

2.5 Comparing and Contrasting Scaffolding, Assisted performance and Guided participation

This section compares these three theoretical frameworks. There are a number of similarities between the three theories. The first is that they all incorporate some sort of scaffolding/contingency in one form or another. David Wood's ideas are much more detailed than the other theories, with three forms of contingency: domain, temporal and instructional. However, domain and temporal contingency were later additions to his theory. Domain contingency involves decisions about what to do next in the interactive situation. The child may make a perfectly sound, but different response to the teacher's instruction, thus encouraging the teacher to respond in a way unexpected to his/her initial questioning. Temporal contingency is also important because instructions can be made at anytime in accordance with the interactive situation.

The second similarity especially in the more recent accounts is the important role of the child. The child is seen now as an interactive partner, who could take the lead role in solving problems. The child or 'less expert' novice has the opportunity to develop proceedings according to his/her activity to cope with the task.

The adult/teacher now has the important role of providing contingent instruction or assistance, which will get the best from the child.

However there are a number of differences between the theories. The main difference between the theories is that, Wood does not include the important role of the adult in structuring the learning environment.

Rogoff in her theory discuses this a lot and mentions the work of Burton et al. (1984) on their analysis of learning to ski. Tharp and Gallimore also include as their seventh means of assisting performance and facilitating learning. They look at assessing and assisting learners, and by collaborating in this way, allowing the tutor to be responsive to the child's emerging capacities and that assistance is within the ZPD. They continue to argue that teaching becomes assisted and that performance is achieved with assistance. This is true to some extent in rowing, but assessing is really redundant until the leaner is quite competent at the task.

2.6 Review of Studies on Scaffolding

The purpose of this section is to review the literature on scaffolding, in particular the effectiveness of scaffolding on young children's learning. Arguably, the major empirical research addressing the effects of scaffolding are to be found in the work done by Wood and his colleagues (e.g. 1975; 1976 and 1978) which described the strategies by which parents support children's learning through interventions that provide task information at different levels of structure, depending on the child's present capabilities and which then went on to study experimentally the effectiveness of such alternative strategies for assistance (teaching) strategies.

Indeed Ratner & Stettner (1991) suggest that studies of scaffolding effectiveness have been relatively rare and offer mixed support, and that those that have been carried out owe much to the design of Wood's early work.

It is also fair to say that studies on scaffolding have focused on young children aged between 3 and 5-years-old -and have tended to involve a maternal parent as the social partner (e.g. Hodapp et al.,1984; Pratt, et al 1988; and McNaughton et. al.,1990), though experimenter-assistants have also been used, as will now be described.

Most of the studies of scaffolding are laboratory or classroom based, usually carried out in formal settings. These tend to involve young children and use parents or experimenter as the tutor.

Very few studies are carried out in an informal environment, such as rowing. Rowing is seen as ' informal', because it is not classroom based with distinctive boundaries between the teacher and the child. Rowing usually takes place outside of school hours and the coach is not seen as a teacher who could sanction any child. First names are used and there is not a clear start and end time to the coaching session. Training/teaching sessions are based on the availability of the boys and the coach.

The aim of this section is to look at some of the studies carried out in relation to this study. This section will look at correlational studies, experimental studies, observational studies and large-scale teaching interventions. Each section will finish with a discussion of the methodology employed in these studies, in particular looking at the reliability, internal and external validity of the studies. Heiman (1995) defines reliability as the degree to which the measurements are consistent and contain a minimum of measurement error. Thus reliability means that if the study on scaffolding was conducted again would the same findings be observed and it also means that if a different researcher observed the same behaviour would they report the same findings. Internal validity is the degree to which the observed relationship reflects the relationship between our variables. For example a study of scaffolding would have low internal validity, if it was found that time on task and not scaffolding that was positively related to learning. External validity is the degree to which our results can be found with other participants and in other situations.

For example, a laboratory study of scaffolding would have low external validity if the finding that scaffolding is related to learning, is only found when the study is conducted in the laboratory

2.6.1 Correlational Studies

Most of the research on scaffolding has investigated the correlation between parents' teaching behaviour and children's subsequent individual performance. This section begins by looking at Wood & Middleton's (1975) study, since much of the research for the pilot in this report derives from their methodology.

The earliest study, which tends to be cited in this area, is that of Wood and Middleton (1975), who investigated the strategies applied by mothers when asked to help their own 3- to 4-year-old children assemble a construction toy. The effectiveness criterion was supplied by the degree of success achieved by the child when asked to complete the puzzle on their own following their "training". The scaffolding was carried out on a one-to one basis. Wood and Middleton found that mothers adopted strategies of varying degrees of contingency with respect to their children's needs.
The proportion of interventions that were in the region of sensitivity ranged from 0% to 50% and the proportion that, were contingent, ranged from 0% to 84%.

The study found that there was a very high positive relationship between measures of scaffolding and the success achieved by the child in later independent problem solving. Table 2.1 shows the correlations between the measures of scaffolding and later individual performance.

Percentage of Interventions	Children's Subsequent Individual Performance	
	Task Appropriate Behaviour	Error Rejection
Region of Sensitivity	0.80*	0.89*
Contingency	0.85*	0.83*

*p< 0.05

Table 2.1 Findings from Wood & Middleton (1975)

These figures show a strong relationship between the mother's teaching behaviour and the later performance of the child. Those achieving the best results tailored their scaffolding to their children's needs, guiding at a level that was near the limits of the children's performance, taking into account the children's responses to the most recent instruction, and adjusting the specificity of instruction according to whether the children had been successful.

A subsequent investigation by Wood, Bruner and Ross (1976) sought to study the processes involved when 3, 4, and 5-year-olds had their performance on the same construction toy as used by Wood and Middleton (1975), assisted by researcher-tutor working on a basic set of rules for increasing help to individuals as it became necessary. The results indicated not only that the older children needed less help, but also that the kinds of help required tended to change. Again, in this study the scaffolding was carried out on individual children.

Pratt, Kerig, Cowan & Cowan (1988) extended the research on parental instruction styles by Wood & Middleton (1975) by doubling the sample size to 24 sets of parents and comparing mothers and fathers scaffolding behaviour. They also used three different tasks: a block model construction task, a matrix classification task and story re-telling task.

They measured the parents scaffolding behaviour in terms of the proportion of interventions that were in the region of sensitivity and the proportion that were contingent. Also as in the previous studies scaffolding was conducted on an individualised basis.

Table 2.2 shows that they also found strong positive relationships between measures of scaffolding and subsequent individual performance.

	Blocks		Matrix		Story	
Percentage of Interventions	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers
Region of Sensitivity	0.51*	0.66*	0.55*	0.70*	0.42	0.15
Contingency	0.43	0.73*	0.51*	0.53*	-	-

*p< 0.05 Table 2.2 Findings from Pratt et al., (1988)

They also found no significant difference between mothers and fathers scaffolding behaviour.

Pratt, Green & MacVicar (1992) conducted two laboratory based, studies of parent tutoring of fifth-graders' long-division mathematical homework, assessing the hypotheses that this relationship may be linked by differences in the quality of parental teaching strategies. Their study of parental tutoring patterns, were analysed on the basis of scaffolding perspectives of Vygotsky and Wood. In the first pilot study, a system for analysing levels of parental support was developed and validated. The sample consisted of 14 fifth grade children and their mothers. The children were tutored on an individualised basis.

Pratt et al. reported that there was a significant and negative correlation between the child's pre-test score and for each task component: for division it was –0.68, for multiplication it was –0.61 and for subtraction it was –0.81.

As expected, parents gave more support to difficult task components and to children with poorer initial skills, as measured on the pre-test. Table 2.3 also shows that there were positive correlations between scaffolding behaviour and learning.

Percentage of Interventions	Division	Multiplication	Subtraction
Region of Sensitivity	0.55*	0.33	0.72*
Contingency	0.52*	0.16	0.42*

*p< 0.05

Table 2.3 Study 2 findings from Pratt et al., (1988)

The second study replicated these findings with a larger sample and showed that initial differences of parental scaffolding were associated with variations in the quality of children's learning from a tutorial session. As in the first study, they predicted that parents would scaffold their tutoring of long division, so that the less skilled received more help and secondly, that scaffolding and contingent tutoring would be positively associated with children's progress.

This sample consisted of 24 fifth-grade children and their parents. Of the 24 parent tutors, 18 were mothers and the other 6 were fathers. The scaffolding was conducted on an individualised basis. These findings were similar to the authors' first study (Pratt et al., 1998). There was negative correlation between the children's initial pre-test scores and the average level of intervention by the parents for each of the three operations: division estimation $r(21) = -.63$, $p<.01$, multiplication, $r(21) = -.58$, $p<.01$, subtraction $r(21) = -.53$, $p<.01$. Thus parents as a group gave more supportive intervention to those children with weaker initial skill.

The mean use of the contingency rule was 42.1% and the mean use of the region of sensitivity was 26.5%. They also found that there was a positive correlation between measures of scaffolding and learning, although not as strong as in the previous study (see table 2.4)

Percentage of Interventions	Pre-Test Post-Test gain scores
Region of Sensitivity	0.43*
Contingency	0.32

*p< 0.05 Table 2.4 Study 2 findings from Pratt et al., (1992)

Conner, Knight and Cross (1997), conducted a study, which looked at the influence of parent-child instructions on children's competence within several tasks. Thirty two 2-year-old children visited their laboratory twice, once with their mothers and once with their fathers. During each session dyads participated in problem solving and literacy tasks, followed by independent child performance tasks. The study consisted of 16 boys and 16 girls. Mother-child and father-child dyads were assessed during separate sessions at least one week apart and lasting about 1hour. The problem-solving and literacy tasks were split into two parts: a parent-child interaction, (building a tower and reading a book) and child performance task (building a tower without assistance and retelling a story). All the sessions were videotaped.

The authors found that both mothers and fathers utilised contingent dyadic behaviour during interactions with their children. Both parents were equally effective in their use of the region of sensitivity and appropriate shifting during parent-child problem-solving tasks. Conner et al (1997), showed that these findings paralleled those of Pratt et al (1988), who found no difference in parental use of the region of sensitivity and appropriate shifting. For problem-solving tasks, higher rates of non-scaffolding interactions were associated with low levels of child success during independent tasks, while higher rates of scaffolding indications (use of RSI) were associated with high levels of child success during independent tasks (see table 2.5).. This same trend was also found during the literacy tasks.

	Tallest Correct				Correct Sequence			
	Mothers		Fathers		Mothers		Fathers	
Percentage of Interventions	Block	Plat	Block	Plat	Block	Plat	Block	Plat
Region of Sensitivity	25	10	37*	54*	09	13	28	55*
Contingency	51*	17	28	02	41*	17	26	25

*p< 0.05

Table 2.4 Findings from Connor et al., (1997)

As with Pratt et al (1988), this study provided evidence for effective parental scaffolding with young children. Similarly with Wood (1980), this study found that the contingency of the parents' instruction was a positive predictor of child performance during both interaction and independent measures of children's success.

McNaughton & Leyland (1990) investigated the effect of different difficulty levels of a jigsaw task on parental tutoring styles for their 3 year olds. (Their work is strongly influenced by Wood, and his notion of scaffolding). The subjects were nineteen pre-schoolers with mean age of 2 years 11 months. The tasks consisted of 18 jigsaw puzzles, comprising 3 puzzles at each of 6 levels of difficulty.
The children were tutored on an individual basis, rather than a group situation. The level 1 puzzles consisted of 1 to 3 pieces and level 6 of more than 10 pieces similar in shape and colour.

The children were seen in 2 sessions, which were separated by a week. In the first session the mother and her child played puzzles together, with the mothers giving help as and when they wanted to. During the second session, the child worked on his/her own, but in the company of the same observer who had been present during the first session. The child was asked to work through the same set of puzzles as in session 1. Interest was mainly focused on the maternal teaching within the zone of proximal development.

They found that scaffolding amount and style changed as task difficulty increased. When the task was easy, the mother's scaffolding appeared to be concerned with keeping children engaged on task and when the task became more difficult, mother's scaffolding changed to be more sensitive in support of how to solve the problem. Lastly, when the puzzle was most difficult the mother's scaffolding was to make sure their children completed the task, by whatever means.

In sum, the research, which has investigated the correlation between parental scaffolding behaviour and learning, has consistently shown positive and significant correlations between measures of scaffolding and learning. This finding has been reported on a wide range of ages and a wide range of tasks.

The studies reported have primarily focused on parental scaffolding and the scaffolding that was delivered on an individual basis.

Methodological Reflections

These studies do appear to have high reliability. They have been replicated by different researchers, with different age groups from 2 year old children (Connor et al., 1997) to 11 year old children (Pratt et al., 1992), and a range of tasks: from puzzles (Wood et al., 1976) to mathematics homework (Pratt et al., 1992). Therefore there can be no doubt that the studies are reliable.

The problem with correlational studies is that they are prone to low internal validity. All the studies found that scaffolding was related to learning. However, these studies are studies of association and therefore we cannot be certain that scaffolding was causing learning. It is possible that there was a third variable (the child), which influenced both adults' scaffolding behaviour and the child's learning.

These studies also have low external validity. The majority of the studies were conducted in a laboratory setting with artificial tasks and therefore there must be a question concerning whether these findings would generalise to more natural contexts (Wood & Middleton 1975; Wood et al., 1976; Connor et al, 1997 McNaughton & Leyland, 1990). Interestingly Pratt et al. (1992), laboratory study where the parents providing support to their children while they were carrying out mathematics homework. This last study suggests that these finding could generalise to more natural tasks. External validity is lowered because the tutor was often a researcher (Wood,Bruner and Ross 1976) and also with all of the studies there was either a researcher and/or video camera that could influence the behaviour of the parents and the child.

2.6.2 Experimental Studies

Controlled experimental studies can investigate whether scaffolding causes the learning benefits reported in the previous section.

Wood, Wood and Middleton (1978) reported an experimental study where a researcher-teacher assists the three to four year old children using one of four different strategies derived from the previous studies of mother-child interaction.

The first strategy was the "contingent approach" and was based on scaffolding and involved a graduated set of five levels of help. The levels of help were as follows (Wood, Wood & Middleton, 1978, p132)

Level 1: General verbal encouragement. The instruction urges the child to action with a general request e.g. 'Good, do something else now' or ' See what you can make.'

Level 2: Specific verbal information. The instructor tells the child what to look for, or how to put blocks together i.e. mentions size, pegs, holes and other criteria attributes.

Level 3: Selection. The instructor becomes physically involved, by selecting or indicating appropriate pieces.

Level 4: Prepared material. The instructor places the blocks in such a way that the child need only push them together.

Level 5: Demonstration. The instructor demonstrates one operation or step in the construction.

The tutor in this condition would only offer support when the child needed it and would then proceed through the various levels of help to the extent that this was shown necessary by the child's subsequent difficulties.

The second strategy was a purely verbal approach. The child is told each step of the procedure with no physical intervention from the instructor. (All levels 1 and 2). The third strategy was Swing. The instructor 'swings' from non-specific verbal encouragement (level 1) to demonstration (level 5) and back again. The fourth strategy was Demonstration. The instructor simply puts all the blocks together in sequence while the child is asked to look on (all level 5).

Following the tutorial session, the instructor immediately took the pyramid apart again and asked the child to put it together without help. This "final independent performance" was scored in various ways, major interest being in the outcome score, that is, the number of unaided correct assemblies or operations performed by the child. On this measure, as predicted from Vygotskian theory, the contingently taught children significantly outperformed all other groups, which in their turn did not significantly differ amongst themselves. The means were contingent 15.0, verbal 6.2, swing 4.0, demonstration 2.6.

At the time Ratner & Stettner (1991) made their comment Wood et al., (1978) was the only experimental investigation of scaffolding. However in the last ten years a number of other studies have been published which have investigated scaffolding experimentally.

The first was reported by Pacifici & Bearison (1991) who conducted a laboratory investigation of scaffolding by comparing children interacting with their mothers (mother-child condition) with children interacting with an experimenter who was trained to provide contingent tutoring (idealised condition). The children were aged between 2 and 4 years old and the task was a truck puzzle, which was adapted from Wertsch et al., (1980). The study took place over three sessions in a day care centre the children were attending.

The first session was a pre-test, the second session was the interaction session where the children worked individually with their mother or the experimenter and the third session was the post-test. The proportion of contingent interventions ranged from 92% to 100% in the idealised condition and ranged between 38% to 85% in the mother-child condition. Children in the idealised condition had significantly higher post-test scores than children in the mother child condition.

Another laboratory study of scaffolding, was conducted by Day and Cordon (1993). Day and Cordon carried out an experimental comparison of the effectiveness of scaffolded and non-scaffolded instruction in helping nine-year-old children to master a balance scale task adapted from Siegler's (1976) study. They used Wood's 'swing' notion of teaching as the non-scaffolded instruction.

The children were taught on a one-to-one basis by one of the researchers who were trained to provide either scaffold instruction or non-scaffold instruction They expected that the children who received scaffolded instruction would perform better as a group on transfer tasks than those who received non-scaffold instruction, because scaffolded instruction is more finely tuned to the child's current level of performance. They also anticipated that those children would require less assistance than others to learn the task and retain their level of competence. The study consisted of 64, eight to nine-year-old children, randomly assigned to one of the experimental conditions.

The materials used consisted of two balance scales and they conducted both pre-tests and post-tests. The results confirmed their initial hypothesis that scaffolded instruction was significantly different from non-scaffolded instruction.
The level of performance of students taught in the scaffolding condition remained constant across maintenance and transfer post-tests.

Non-scaffolded condition declined from maintenance to transfer post-tests. Additionally, children taught by scaffolded instruction, required significantly less examples and explanations to learn how to solve balance-scale problems. Scaffolding also reduced the variability among children in how quickly they mastered balance-scale problems.

A more recent experimental investigation of scaffolding, was reported by Pratt and Savoy-Levine (1986). They reported two separate studies where they compared different types of instruction given to children. In the first study, they had three tutoring conditions based on Wood et al.'s (1978) study, contingent tutoring, moderate support (consistently intervening with a structured verbal suggestions) and high support' (providing answers, and indicating each step and the use of Wood's demonstration condition). The children (n= 30) were aged between 9-11 years. The had four sessions: a pre-test, an interaction session where they were taught individually about long division depending on which condition they were in, an immediate post-test and a delayed post-test. They found that the contingent tutoring group showed a substantial gain after the tutoring session, which was maintained over subsequent post-tests. The high support groups showed no gains, however the moderate support group showed a gain at the first post-test, but this disappeared in the delayed post-test.

Pratt and Savoy-Levine (1986) reported a second study where they compared five different types of tutoring: contingent, moderate support, high support, sequential support and a no training control. Forty 9-11 year old children took part in this study, which like the previous study had four sessions: a pre-test; a tutoring session, where the children are taught individually depending on their condition; an immediate post-test and a delayed post-test.

As in study 1, children in the contingent group showed marked gains in the immediate and delayed post-tests. None of the other conditions showed any significant improvements on the immediate or the delayed post-test.

In sum, a number of studies were reviewed which have experimentally investigated the effects of scaffolding. They have consistently found that children, who are taught individually, using the principles of scaffolding improve significantly better than children taught using over techniques. This positive result has been reported for a wide range of ages, from 2 to 11 years old, and on a number of different tasks from construction toys to science and mathematics.

Methodological Reflections

These studies also appeared to have reliability. They were replicated by different researchers and different age groups from 2 year old children (Ratner and Stettner, 1991) to 11 year old children (Pratt and Savoy-Levine 1986). The researchers also used a wide variety of tasks, from construction toys (Wood et al., 1978 Pacifici & Bearison 1991) to science and mathematics (Pratt and Savoy-Levine 1986).

These studies are experimental studies and therefore have the advantage of high internal validty. All the studies were carried out under controlled laboratory conditions and showed causal relationships; that is, the children taught using scaffolding techniques performed better than those children taught by any other method. The children were randomly allocated to conditions and so therefore we can be almost certain that scaffolding caused the learning.
These studies complement studies reported in section 2.6.1, which were studies of associations and therefore could not directly address causality.

The danger with experimental studies is low external validity. All the studies were conduced in a laboratory setting with artificial tasks, which casts doubt on their ability to generalise to more natural contexts.

A number of the studies used experimenters to tutor the children (Pacifici and Bearison 1991; Wood, Wood and Middleton 1978). All the studies employed researchers to scaffold the children and as with section 2.61, this raises questions concerning whether non-resaerchers could use these techniques and if they can do they use these techniques.

2.6.3 Large Scale Teaching Interventions

This section looks at large scale teaching interventions that are based on the principles of scaffolding. They are interesting because whereas in the previous sections studies were reported where scaffolding had been implemented on an individualised basis, these studies by their nature have developed strategies that are group based.

i) Reciprocal Teaching

The first large-scale teaching intervention was conducted and developed by Brown et al. They called it 'Reciprocal Teaching'. (1986). It was designed to provide a simple introduction to group discussion techniques aimed at understanding and remembering text content. This procedure is based on several theoretical principals concerning the strategies taught, the environment in which they were taught, and the role of the participants. Reciprocal teaching was designed to provoke a ZPD within which novices could gradually take on greater responsibility for learning.

The adult teacher has an explicit instructional goal, and it is part of his responsibility to engage in deliberate scaffolding activities when he works with the current discussion leaders in an attempt to improve their level of participation. Thus, reciprocal teaching is both a co-operative learning group jointly negotiating the understanding task and a direct instruction forum where the teacher attempts to provide a temporary scaffolding to bolster the learning strategies.

Brown et al. (1986) found the procedure being used very successfully as a reading and listening comprehension intervention by average classroom teachers with academically at risk middle school children.

Since 1981 when the programme began, 287 junior high school students and 366 first to third grade children have taken part in the experiments. Brown et al., found that students entering the study scored approximately 30% on independent tests, the authors regarded 75-80% correct on five successive days to be successful. They found that 80% of the students were judged to be successful, and furthermore, these students were able to maintain more independence when given instructions.

From these findings it seems that positive attributions within the scaffolding process contribute significantly to the transfer of responsibility from adult (other-regulation) to child (self-regulation).

ii) Keep

The second major teacher intervention, which is based on scaffolding is the Kamehameha Elementary Education Program (KEEP) in Hawaii conducted and reported by Tharp and Gallimore (1988). This is perhaps the most impressive and extensive test of Vygotskyan ideas that comes from the 10-year project. This was a research and development programme built upon neo-Vygotskyan principles at all levels, from the assisting of pupil learning to the development of teachers and their teaching skill. The children participating in the programme were deemed 'at risk" educationally.

The complex results were very supportive of the KEEP approach, though it should be remembered that this programme was a complex and long-lasting field intervention which consisted of an extensive set of specific strategies (classroom activity centres, forms of teacher assistance and praise, etc.) designed to embody Vygotskian principles.

iii) Reading Recovery

Reading recovery is another teacher intervention program based on scaffolding principles. Hobsbaum et al., (1996) looked at scaffolding in reading recovery, which is a one-to-one intervention for children having difficulty reading after one year at school. The sessions consisted of daily half-hour lessons taught by a teacher trained to diagnose and support children's problem solving approach to reading, over several school terms. The lessons were organised so that the pupil (of what ever ability) was able to 'act like a reader and writer'. Their study was carried out over several terms on a sample of 17 children taught by seven trained teachers.

The reading recovery lessons conformed to many aspects of scaffolding by Wood and his colleagues. The reading recovery lessons comprised of several elements whose precise content varied on each on each occasion to suit the learning needs of the individual child. The whole emphasis of the programme was to encourage the child to behave as independently as possible, with the teacher guarding against providing too much support or reducing the child's initiative. It was necessary for the child to remain in control of the task.

The interactive context used for the study was the writing component of the reading recovery lessons, in which a sentence was composed or generated by the child and teacher about a previous text shared in a lesson or of an account of personal experience. Both worked together to produce a written text, with the teacher providing contingent assistance and prompting the child to take over more of the responsibility for the task as their skill developed.

The reading recovery programme was used in different schools in London and Southern England, where the children were observed once at the beginning and once towards the end of the programme. A total of 75 lessons were observed; they were audio taped and fully transcribed.

The analysis was conducted by scrutinising teacher-child moves in relation to each other, rather than isolated counts of initiating and responding. Patterns of interaction in terms of structure and talk cycles were identified. Movements between cycles were categorised by the times the teacher leads and occurrences of child leads.

They found that talk cycles were established and types of teacher leads identified and quantified. The authors' observations showed how initially teachers monitored and structured the learning within the task, which gave way to children's independently identifying their needs by asking relevant and subtle questions. The children knew their next move, so there was a shift in control. The children began to internalise the teacher's prompts and social exchanges and began to exercise increasing control over cognitive processes through the use of language. The authors also found the writing episodes matured as a result of intricate teacher decisions as they operate at the outer boundaries of the child's zone of proximal development.

Although Hobsbaum and her colleagues found scaffolding useful, they conclude by saying that scaffolding can only take place only in a one-to-one teaching situation, because contingent responding requires a detailed understanding of the learners history, the immediate task and the teaching strategies needed to move on.

The above section reviewed some large-scale teaching interventions, which were based on the principles of scaffolding. Some impressive results have been reported showing significant and substantial benefits. Interestingly, for this thesis they involve group-based tuition and the scaffolding was delivered through the structuring the interaction between the children and not so much through the teacher providing contingent support. In fact Hobsbaum explicitly states that contingent instruction is only possible in one-to-one teaching situations.

The large-scale teaching interventions in this thesis have tended to focus directly on children's explanations. Such explanations have served a variety of function: 'sharing' and 'displaying'. An explanation has a sharing function if the speaker is producing it in order to share his/her knowledge with other people, and so extend their understanding.

Explanations are also produced to demonstrate that the speaker possesses a particular piece of information. The sharing function is particularly important. Donaldson (1978) argues that the children's explanation in schools, encourage peer learning groups and discussions in which the teacher assumes a facilitatory role rather then a didactic role. Shifting responsibility from the teacher to the child allows greater understanding of explanations and given greater independence when given instructions.

However, classroom interactions, by their nature, involve group based activities and interactions, thus making scaffolding difficult to observe and achieve. That said these studies are interesting in themselves, since they provide valuable information about teaching and learning.

Methodological Reflections

The reliability of these studies is high because All the studies found that scaffolding was related to learning to some degree. They also used a varied approach, with either 'at risk' children (Tharp and Gallimore 1988); or children just starting to read (Hobsbaum et al.1996). All the studies were conducted in classroom conditions with trained investigations, over long periods of time, ranging from several school terms- 75 lessons (Hobsbaum et al.1996); to ten years (Tharp and Gallimore 1988).

These studies were quasi-experiments and therefore have the disadvantage of being prone to low internal validity. These studies did not randomly allocate the students to conditions and therefore we can never be a 100% sure that these differences were caused by the intervention. However, the consistent findings across different groups and different researchers make us more confident regarding the internal validity of the findings.

These studies have high external validity. They findings reported suing these interventions would generalise to other contexts because they were conducted under classroom conditions- even though trained investigators were used.

6.4 Observational Studies

The next section reports research from a number of observational studies on scaffolding. These studies have generally investigated one-to-one interaction (mother-child interaction) or small group interaction.

i) Informal Education

One of the first observational studies of scaffolding, was conducted by Greenfield and her colleagues (1984). They observed how scaffolding worked effectively in informal education when girls in Guatemala learned to weave. The beginners who had no knowledge and first timers learned best in the shared activity, and scaffolding was found to be fuller when the task was most difficult and at the beginning of the task. The observers lived among the families and became part of the community. The observations were carried out in a natural context; the observed felt comfortable with the situation and carried out their business without feeling threatened.

Similarly, from the study of American and Mexican maternal interaction with toddlers, Farver and Howes (1993) indicate that cultural norms and practices may influence both who provides scaffolding and the nature of what is offered. For instance, Mexican children's scaffolding of pretend play appears to come from their siblings, not their mothers, who are more likely to prompt play with real life material. As with Greenfield and her colleagues (1984), the authors in this study lived with the families.

ii) Mother-Child Interaction

A number of very detailed studies of scaffolding have been conducted in the context of mother child interaction. These studies have generally found a lot evidence for scaffolding in this context.

Saxe (1997) investigated the interplay between social and developmental processes in children's numerical understandings in working class and middle class home settings. Methods include interviews with 78 working and middle class 2.5-4.5 year-olds, to assess their numerical understandings; to interview mothers about their children's everyday number activities and observational studies of mother-child aims in interactions during normal activities. The authors partitioned their observations into two sections, one at home and the other at the local primary school (laboratory). Each observation session lasted between two and three hours, and the mothers were usually interviewed within a week of the observation for 15-20 minutes. The whole project lasted for several months and during this time, all the participants got to know each other quite well and the 'home' observations were conducted as an everyday situation in a natural context. Saxe (1997) and her colleagues provided evidence that in mother-child teaching interactions, mothers adjusted their goal structure of a given activity to reflect their children's activities to structure numerical goals, and children adjusted their goals to their mothers' efforts to organise the activity

To examine mothers' adjustments to their children's abilities, the authors analysed whether mothers matched their type of instruction to the sub-goal with which their children were experiencing difficulty, whether mothers adjusted the specificity of their instruction as a function of children's ability and whether mothers offered more specific correspondence and sequence instruction during the interaction in response to children's error. An example of a mother instructing her child is given below.

1	Mother	Count the dots.
2	Child	Recites "one" through "six" correctly while haphazardly pointing to the dots.
3	Mother	Start over, and this time count the dots in rows.
4	Child	Correctly counts the bottom row and continues to count "five, six, eight," while pointing to the first, second and third dots in the second row.
5	Mother	No. What comes after six?
6	Child.	11
7	Mother	Seven comes after six.
8	Child	Repeats "seven, " counts "eight" and "nine" while pointing to the next two dots, and then begins to point to the first dots of the bottom row again.
9	Mother	You already counted that row. Now count the dots in the top row. (pointing to the top row)
10	Child	Correctly counts the top row to 13.

The extract above shows how the mother is scaffolding her child by providing contingent help. The child is doing well until line 4, when he makes a mistake. The mother is quick to respond, line 5; she gives him every opportunity to correct his mistake, and when he gets it wrong again, line 6, the mother provides more help in line 7.

At this stage, the child's attention is still with the numbers, because the mother is pointing at them. The child is not allowed to lose concentration. During line 8, the child counts correctly with the mother pointing at the next numbers in the row. The mother is guiding the child towards the goal, by responding immediately to any error made with easy steps to correct it. The mother is helping he child to reproduce what it already knows, and scaffolding is much about support rather than tuition; thus encouraging the child to succeed after instruction, making sure the task is within the child's ability to keep him/her focussed and interested.

The authors agreed that for the children's errors of which there were 82.5% was followed by maternal instruction at a 96.7% rate. The conclusion was that mothers did respond to their children's errors with instruction, and they did adjust to their performance.

To examine children's adjustments to their mothers' instruction during reproduction tasks, the authors compared both children's use of counting and task success in their unassisted and assisted performance. Their results show that 61% of those children who did not count when unassisted did at least some counting when assisted by their mothers. The 4 year-olds were more likely to shift to counting with their mothers than the 2 year-olds.

Barbara Rogoff (1993) and her colleagues reported similar findings across different cultures. She examined how toddlers and their caregivers from four cultural communities collaborate in shared activities. The interesting factor here is that, the authors became part of the cultural setting. They lived within the community they were studying, and shared in the everyday chores of the community. In this situation, the observed forgot or became used to the investigative situation. It was hoped that the observers' position did not affect the running of everyday activities, thus limiting bias from both parties. An example of the confidence between the observer and observed was indicated in the Turkish study, where the observer was known as 'abi' or older brother. The authors focus on both similarities across communities in the process of guided participation and on differences in how guided participation occurs (See Section 2.4).

They examine the idea that a key cultural difference entails who is responsible for learning (whether adults taking responsibility for structuring teaching situations or whether children take responsibility for learning through observation and through participating in adult activities with caregivers support). The authors speculate that these two patterns relate to cultural variations in the segregation of children from adult activities of their communities and in emphasis on formal schooling. The four communities of their study vary across these lines as well as in other ways.

The communities were:

A Mayan Indian town in Guatemala
A middle-class urban group in North America
A tribal village in India
A middle-class urban families in Turkey.

Barbara Rogoff and her colleagues argue that across communities, guided participation simultaneously involves both similarities (bridging and structuring) and variations (in goals of development, means of communication, and asymmetries in adults and children responsibility for learning).

Before leaving our discussion of scaffolding and mother child interaction, a very interesting observational study was reported by Gelman, Massey & McManus (1991). They looked at museum learning at the Please Touch Museum (PTM) in Philadelphia. It serves a target population of children up to the age of 7, so the target clientele, must be accompanied by responsible adults. The museum attracts mixed racial and socio-economic groups and receives about 140,000 visitors a year. The authors spent 4 years observing the exhibit areas from afar as workers and assistants. In this way, the observed (without knowing they were being watched) continued to enjoy what the museum had to offer without feeling limited in their behaviour. Behaviour by the participants in this situation was completely natural. As the PTM is a natural research setting, the authors could observe adult-child interactions without asking questions. They observed successful interactions of turn taking between the adult and the child. The exhibit area varied in type and so did the way the visitors used them. Samples of interactions were taken from the Grocery Store and the number exhibit (1-2-3 Go!), to illustrate some of the differences. In the real world grocery stores are common everyday settings for both children and adults. The Grocery Store at the PTM (close to life size) is more like a corner shop than a large supermarket. It contained all the usual supplies.

The authors found that in this setting, the parents introduced and organised the children's activities and that 45.5% were adults prompting, requesting or ordering the children to do something.

The PTM mounted a special exhibit on the numerical concept. The 1-2-3 Go! Exhibit included displays to encourage children to count, order, classify, match, to use quantitative vocabulary and to estimate. The 'How Many Box' was one of the displays meant to support such activities.

This exhibit was as popular as the Grocery Store. For the children to be able to use the exhibits as the design intended, the adults would have to read the signs to them. To the authors' surprise, the adults did not read the few words on the sign.
Of the 43 adults observed in one set of observations, only a third asked 'How Many' questions, 19% counted or encouraged the children to count and 30% of the adults simply stood still or sat at one side while the children lifted and shut doors. The adults observed in this study were also very reluctant to relinquish control. Instead they were determined to control the flow of events. Often, more concerned that their child did the proper thing than play and have fun.

The authors found when an adult read the signs and counted or encouraged counting on the part of their charge, that the child was more likely to count than were other children who did not encounter such support. However, such scaffolding was rare and seldom lasted long enough to guarantee that a child reached the intended goal.

iii) Classroom Based Observations

There have been a number of observational studies of scaffolding in the classroom, which appear to show how difficult scaffolding is in grouped activities. Fleer (1992) reported an observation study of scaffolding in a classroom.

She observed the role of three teachers in using an interactive approach (Scaffolding vs. non scaffolding) to teaching scientific thinking to children in three classroom situations (5 year-olds, 5-7 year-olds and 7-8 year olds). She observed scaffolding in one of the three teachers when she was interacting with the child on a one to one basis or in small groups of 3. Fleer observed this teacher in a process of hand over where the teacher progressively allowed the child to take more responsibility.

Maybin, Mercer & Stierer (1991) also reported an observational study of scaffolding in a classroom context. They report a number of sequences, which they argue exhibit scaffolding. The example below is between a teacher and two eleven-year old boys on a science activity.

1	S1	Well, that's pointed
2	Teacher	Um
3	S1	And that one isn't
4	Teacher	I think perhaps, think you are limiting your thoughts to shape at the moment. Think about other things.... Some other variables that you could look at
5	S2	Colour
6	Teacher	Try colour
7	S2	Is it that sort of colour. Is it dark? That is Dark.
8	Teacher	You are going to have problems. People would say, well compare. If someone said to you, which is the dark one of those two, you would immediately point to that one. Now, this is where the difficulties arise, isn't it, because there is no doubt which is the dark one here
9	S1 & S2	Yeah
10	Teacher	And at first glance at the whole group there is no doubt, which is the dark one there but if that was the only shell you had, and someone said to you which was the dark one, what would be your answer.
11	S1	Yeah
12	Teacher	You would probably say Yes. S2 you might say No. I mean I think I would probably say 'No it isn't dark shell. But I mean, I'm sure that if you went round the class you would find half the class would say that was dark and half the class would say it was light. So it might not be a good question. Simply because people's judgement of what dark and light varies.

The teacher in the above sequence tries to draw out from the boy's ideas, which he knows will lead them to the correct solution (see line 4). Providing feedback on their suggestions and showing weaknesses (line 12).

The boys with scaffolding exhibited above are able to classify some shells in a scientific manner.

In sum, observational studies have reported some levels of scaffolding. However, these studies were generally conducted with small groups of children or individual children.

Methodological Reflections

The reliability of these studies is quite high Although some of studies did not report inter-rater reliability (e.g. Maybin, Mercer & Stierer,1991), the majority of the studies had reliable levels of inter-observer reliability. There was also inconsistent reporting of the amount of scaffolding observed. All the studies investigating mother-child interaction or in the home situation, report high levels of scaffolding. Greenfield (1984) in her observational studies of weaving reported evidence of scaffolding.. Farver and Howes (1993) found that scaffolding comes from the siblings during pretend play. Saxe (1997) found that scaffolding was evident during mother-child interactions of everyday numerical understanding. Similar findings were reported by Rogoff et al.(1993). They examined how toddlers and caregivers from four diverse cultural communities collaborated in shared activities. The authors found that adults served to bridge the gap between the learners' existing knowledge and the demands of the new task.

However, outside of the home and in-group situations scaffolding is not so evident. Gelman, Massey and McManus (1991), found that scaffolding was rare and seldom lasted long enough for children to reach their intended goal. They observed that in only a few cases did the adults attempt to help their children. Fleer (1992), found that effective scaffolding was limited, in a classroom situation. She only observed scaffolding with one of the three teachers in her study. Maybin, Mercer and Stierer (1991), also found that scaffolding was difficult to achieve in a classroom setting.

The problem with observational studies is low internal validity. The researcher can never be sure that the findings they report concerning scaffolding were not caused by other variables. Although, most of the observational studies were not examining the issue of whether scaffolding causes learning they were examining the incidents of scaffolding. However, even with the incidence of scaffolding there is an issue of internal validity. If scaffolding is observed then it is assumed that the person observed is using scaffolding, however unless the person is asked whether they were using scaffolding, it is not possible to say with complete certainty that they were employing scaffolding strategies. One possible way of overcoming this problem is through interviewing the participants, which is what Saxe used in his study.

The degree external validity depends on the type of observation conducted. These observational studies used either participant observation where the observer engages in the very activities s/he sets out to observe (e.g. Greenfield et al 1984; Favour and Howes, 1993; Rogoff et al 1993), or non-participant observation, where the observer stands aloof from the group under investigation (e.g. Saxe 1997; Gelman et al., 1991; Fleer 1992; Maybin et al., 1991). Non participant observation where there is a external researcher observing the participants can lead to atypical behaviour and thus can be prone to low external validity. Using tacit observation can lessen this, although this does have ethical problem. In the group of studies that used non-participant observation, Gelman et al (1991) used the technique of tacit observation, where the participants were observed without their knowledge. He resolved the ethical problem by asking participants after they were observed if they were willing to be participants in the study. Participant observation generally has high external validity.

In fact, Robson (2002) argues that the key advantage of participant observation is that it leads to be more naturalistic observations and that the behaviour under observation would change if the participants being observed knew they were being observed. Thus participant observation is very high in external validity.

2.7 Criticisms Of The Metaphor

Although scaffolding has been widely used and accepted by researchers, a number of criticisms have been made. First, scaffolding tends to focus on the adults as an agent for instilling new skills and understanding. Rogoff (1990), argues that peers can be a valuable source of new learning, and that adults play a much less important role than peers in everyday learning opportunities in some societies. Secondly, there is the conception of adult-child interaction as too-other-driven or one-sided in nature. The child has very little role to play in the scaffolding process. Thirdly, scaffolding assumes an ideal metaphor of adult-child relationships. Litowitz (1993) and Goodnow(1990) argue that such interaction is not as affect-neutral as they are assumed to be. Litowitz, in particular pointed out that there is a conflict of interest in parent-child relationships. Goodnow pointed out that negative values are sometimes attached to objects or skills to be mastered. Fourthly, scaffolding encourages us to focus on quantitative rather than qualitative changes in children's knowledge. How much a child can do now, without really understanding the subtle changes that have taken place. Finally scaffolding said too little about the nature of communicative mechanisms involved. Studies here have tended to focus on the outcome, rather than the social interaction that has taken place.

There are clearly some criticisms of scaffolding, but the overwhelming evidence suggests that, it is a useful tool for effective instruction and learning. Some of the criticisms are justified; particularly those studies which pay little attention to the environment and social setting. However, it is with strong belief that scaffolding is a positive method of learning that justifies its position within the boundaries of cognitive psychology and child development.

2.8 Methodological Issues

The pervious section reported a number of criticism of the metaphor of scaffolding, this section provide a critical review of the methodological issues surrounding the literature review and provides a rationale for the methods used in the thesis.

Section 2.6.1 reviewed a number of correlational studies of scaffolding. Most of these studies were conducted in a laboratory (Wood and Middleton, 1975; Wood, Bruner and Ross, 1976; Pratt, Kerig, Cowen and Cowen;; Pratt and Savoy-Levine, 1986) or when conducted in the field were conducted under tightly controlled conditions (Pratt, Green and MacVivar; Conner, Knight and Cross, 1997; McNaughton and Leyton, 1990; Pacifici and Bearison, 1991). These studies were found to be reliable, but they had low internal validity and because they were primarily conducted in the laboratory or under tightly controlled conditions they had low external validity. The latter problem is not endemic to correlational studies and it is possible to carry out correlational studies in naturalistic contexts.

Section 2.6.2 reviewed experimental studies of scaffolding. Most of these studies were conducted in a laboratory (Wood, Wood and Middleton, 1978; Pratt and Savoy-Levine, 1986; Day and Cordon, 1993;) or when conducted in the field were conducted under tightly controlled conditions (Pacifici and Bearison, 1991). These studies were found to have high reliability and high internal validity. However the problem with these studies was they had low external validity.

This problem is particular acute in research concerned with scaffolding, because Gelman et al. (1991) showed that under naturalistic contexts very different behaviour was observed to the behaviour reported by researchers who employed laboratory style methods. Therefore, it was decided not to use laboratory style studies because of the importance of studying behaviour in its natural context.

Section 2.6.3 reviewed a number of large scale teaching interventions that were based either partly or whole on scaffolding. These were 'Reciprocal Teaching' by Brown et al. (1986); the 'Keep' project by Tharp and Gallimore (1988) and 'Reading Recovery' by Hobsbaum et al (1996).

The aim of these studies was to formally evaluate the effectiveness of these teaching interventions and on the whole they found that they were effective. Methodologically, these studies had high reliability, but because they were quasi-experimental they suffered from low internal validity.

Section 2.6.4 reviewed observational studies of scaffolding. These studies could be split into three distinct areas: informal education, 'mother-child interaction' and classroom based observation. These studies found evidence of scaffolding; especially within the informal education and the mother-child interaction. These studies when conducted properly had high reliability. The degree of external validity varied depending on the method that was employed. Participant observation had the highest level of external validity leading to observations of naturalistic behaviour. The degree of internal validity also varied depending on the claims made. If the studies made claim concerning the causal nature of scaffolding these studies had low internal validity. They had higher internal validity if they were observing the incidence of scaffolding. However, when studies reported the incidence of scaffolding, there is still an issue concerning whether the participants were actually intentionally using scaffolding. This problem could be overcome by combining participant observation with interviews.

Therefore, it was divided to use a combination of participant observational and interview studies. In participant observation, the observer engages in the very activities s/he sets out to observe. Often, his/her 'cover' is so complete that as far as the other participants are concerned, s/he is simply one of the groups. However, such complete anonymity is not always possible (or desirable). Cover is not necessarily a prerequisite for participant observation.

The main advantage of participant observation as a technique is its directness. Participant Observation also appears to be pre-eminently the appropriate technique for getting at 'real life' situations.

However, participant observation has a number of problems. It is often described as subjective, biased, impressionistic, idiosyncratic and lacking in precise quantifiable measures that the hallmark of survey research and experimentation However, the observer may be said to 'lose' his perspective and become blind to the peculiarities that s/he is supposed to be investigating.

This problem was overcome by the fact that video recording were made of the coaching sessions. Video recordings were considered a normal part of the coaching and learning process, and seen as routine. The video recordings were then used to analyse the behaviour of the coaches. The analysis used a coding scheme, which could then be checked for inter-observer reliability. Thus reducing the biased and subjective nature of participant observation.

The final study was an interview study. The main reason for using interviews was to ask the coaches what they did and see if that corresponded with what was found in the observational studies. Observing behaviour is a useful enquiry technique, but asking the coaches directly about what was going can provide an insight into coaching which observational alone will not answer. For example, coaches can be asked if they use scaffolding, which observation alone cannot answer. Using a combination of observation and interview techniques can provide the best of both worlds. The observations can show what the coaches actually did and the interviews can provide insight into why they did it.

There are a number of different types of Interviews. There is the structured interview, which has predetermined questions with fixed wording, and administered in a particular order. There is also the semi-structured interview; again with predetermined questions, but with the interviewer's skill and perception to alter or modify the wording.

There is also the unstructured interview, where the interviewer lets the conversation develop around the topic. A semi-structured interview was used in this thesis. The main advantage of using this method was to allow the interviewees, more flexibility totheir responses. Secondly, there were pre-determined questions, where the order could be modified based upon the interviewer's perception of what seemed appropriate. Question wording could be changed and explanations given at any time.

Therefore in conclusion the thesis is going to use a combination of participant observation and semi-structured interview techniques to investigate the uses of scaffolding in learning to row.

2.9 Discussion and Conclusion

This chapter initially compares three theories of how adults help the child to carry out tasks. The first was Wood's theory of scaffolding looks at the interaction between the adult or 'expert' and the child 'less expert'. This theory is designed to explore the nature of support the adult gives to the child. This helping process is characterised according to five feature (see 2.2) and that contingency and activity within the region of sensitivity are all part of the scaffolding process. Wood's later work includes domain and temporal contingency to his already established instructional contingency. The region of sensitivity is a hypothetical measure of the child's current ability and his 'readiness' for different types of instruction. The child is only asked to do one extra operation without putting too much burden on his/her current level of ability. The expert needs to know when and how much help is to be provided. Wood's later work saw the child as taking a more active role in his/her learning.

The second theory was Tharp and Gallimore's (1988) theory of assisted performance is closely related to Wood's theory of scaffolding. Assisted performance begins by looking at the child's current level of understanding, and how the teacher assists the child to pursue the required goals. The teacher thus becomes responsive to the child's needs and together they reach the instructional goals.

The third theory was Rogoff 's theory of guided participation. She identifies four processes involved in guided participation. (see 2.4) She argues that effective collaboration between the adult and the child is where the adult provides a 'bridge' between the learners' existing knowledge and skills used by the demands of the new task. Rogoff's concept of guided participation provides a process by which children develop through their participation with others during everyday activities; either by direct instruction from adults or by interacting with their peers. The interesting thing about guided participation is the shift in 'power' from the tutor to the child. Thus effective guidance involves the transfer of responsibility from the tutor to the learner.

All of the above theories have some notion of scaffolding and contingency, although Wood (1996) has a more detailed concept of the latter.

The interesting element to all these theories is that they all mention the role of the child to some extent, and not just the adult/expert instructing the child/learner. The role of the child is crucial to understanding the nature of scaffolding. However, the main difference between the theories is how the adults change the learning environments and activities within them. How much control do the adults have? Cultural variations may dictate activities and learning environments.

This chapter then reviewed the studies that have investigated the effectiveness of scaffolding. Correlational, experimental and large scale teaching interventions have all shown that scaffolded instruction is effective across a wide range of ages and with a number of different tasks. Observational studies have found evidence of scaffolding. However this research has still tended to focus on formal subjects, employs young children, the tutors are either parents or experimenters who provide individualised instruction or small group instruction. In fact, Hobsbaum et al., (1996) argued that scaffolding can only take place on an individual basis.

Research using group based instruction (e.g. reciprocal tutoring and KEEP) have used the principles of scaffolding have had to modify those principles to make them applicable in group based situations.

The thesis then critically reviewed the methodologhies employed to investigate scaffolding and used it to provide a rational for the methods employed in the thesis. This section grouped studies of scaffolding into four different groups depending on the methodology employed. The first set of studies reviewed were correlational studies of scaffolding. These studies were found to be reliable, but they had low internal validity and because they were primarily conducted in the laboratory or under tightly controlled conditions they had low external validity. The second set of studies, were experimental studies. These studies were found to have high reliability and high internal validity. However the problem with these studies was they had low external validity. Therefore, it was decided not to use laboratory style studies because of the importance of studying behaviour in its natural context. The third set of studies, were large scale teaching interventions. Methodologically, these studies had high reliability, but because they were quasi-experimental they suffered from low internal validity. The final set of studies reviewed were observational studies of scaffolding. These studies when conducted properly had high reliability.

The degree of external validity varied depending on the method that was employed. Participant observation had the highest level of external validity leading to observations of naturalistic behaviour. The degree of internal validity also varied depending on the claims made. This problem could be overcome by combining participant observation with interviews.

Therefore, it was divided to use a combination of participant observational and interview studies to investigate scaffolding in a more informal setting (i.e. learning to row) and with larger groups (i.e. a rowing eight). It also involved children who were older than the children that have generally been investigated by other studies of scaffolding.

Chapter 3: The relationship between contingent tutoring and learning to row

3.1 Introduction

Chapter 2 reported evidence that scaffolding was effective across a number of domains and across a wide range of ages. However, most of the research was conducted on young children and involved individual tuition. Also research was reported which showed that scaffolding did not occur very often in informal situations (Gelman et al., 1991), nor did it occur very often in naturalistic studies of classroom-based teaching (Bliss, Askew & McCrae, 1996). Chapter 2 also reviewed the methodologies employed and concluded that the most effective methodology would consist of a combination of participant observation and interview studies to investigate scaffolding in a more informal setting and with larger groups. Thus, this chapter reports a participant observational study, which investigated contingent tutoring and the acquisition of rowing by 13-14 year old children in a group-based situation.

The first aim of the study was simply to investigate whether rowing coaches were employing scaffolding in an informal group based coaching situations. The theory of scaffolding predicts that with time, the student will become more proficient and thus the level of instruction provided by the coach in the region of sensitivity would be reduced.

The second aim was to investigate whether the region of sensitivity (level of instruction) would be higher in the earlier instruction sessions than in the later sessions. Scaffolding theory further predicts that the region of sensitivity would be higher for the less able students.

The third aim was to examine whether there was a negative relationship between the region of sensitivity and the boys' initial level of ability.

Scaffolding theory would also suggest that the greater proportion of time the coach was coaching in the region of sensitivity and the greater the proportion of the time the coach was being contingent the greater the learning gain.

The fourth and final aim was to investigate whether there was a positive relationship between learning to row and scaffolding.

3.2 Method

3.2.1 Participants

The study employed twelve boys and one coach. The boys were aged between 13 and 14 years and are from an independent school in South West London. They came predominantly from middle class families and volunteered to learn how to row. The coach was a teacher employed by the School to coach as part of a games session. Permission to carry out the study was sought by the coach and the boys' and their parents were happy to be included.

3.2.2 Procedure

The boys were seen individually and collectively in a crew (a boat of eight) and their instruction sessions were recorded on video-tape. All the boys volunteered to row and agreed to be filmed, since it would be used as a teaching aid later on.

When the boys first saw a rowing boat, they were invited to touch the hull and to feel the weight of the oars. They had little idea about the make of equipment. Then they moved to the rowing tank and were given a demonstration by the coach. Each boy was then given 5 minutes to 'play' around and feel for the nature of the task.

They were then be given a pre-test score on the four basic elements of the stroke which were the recovery, the catch, the drive and the release. Each boy was assessed on these four elements with a score that would range between 1 to10.

After the pre-test there was five sessions approximately a week apart. The first and last session were videotaped. These sessions lasted between one to two hours. All the boys were accompanied and coached by the tutor on the development of their basic rowing stroke.

The Post-test immediately followed the last session and was the same as the pre-test. The reliability of the pre and post-tests were, verified by another coach using the same observational schedule. Inter-rate reliability scores were calculated between myself and the other coach on the four elements of the stroke. They are shown in Table 3.1.

	Pre-Test (n=12)	Post-Test (n=12)
Recovery	0.90	0.67
Catch	0.92	0.84
Drive	0.72	0.73
Release	0.36	0.68

Table 3.1: Inter-rater reliability for the four elements of the stroke.

This showed that there was low agreement on the 'release' aspect of the stroke. The release, is a difficult part of the stroke. The oar can be 'lifted' out of the water in a number of ways. Firstly, this can be done ' incorrectly' by leaning away from the oar, secondly, by wrenching the oar handle and scraping the 'blade' out of the water, and thirdly, by using the correct method, by pushing the hands down at the 'finish' of the stroke. If the observer has not been primed or experienced enough, s/he can easily code incorrectly. The observer needs to be clear about the correct technique. However, this was clearly explained by the time of the post-test.

3.2.3 Analytical Framework

The analytical framework adopted for this study was taken from Wood and Middleton's (1975) five levels of control. Wood and Middleton's (1975) coding scheme has also been used by Pratt, Kerig and Cowen (1988); Pratt and Savoy-Levine (1986) and Pratt, Green and MacVicar (1992) in their studies of scaffolding.

Level 1: General verbal encouragement. The instruction urges the child to action with a general request e.g. 'Good, do something else now' or ' See what you can make.'
Level 2: Specific verbal information. The instructor tells the child what to look for, or how to put blocks together i.e. mentions size, pegs, holes and other criteria attributes.
Level 3: Selection. The instructor becomes physically involved, by selecting or indicating appropriate pieces.
Level 4: Prepared material. The instructor places the blocks in such a way that the child need only push them together.
Level 5: Demonstration. The instructor demonstrates one operation or step in the construction.

The videotapes of session 1 and 5 were analysed to 'measure' scaffolding. The level of intervention was assessed using table 3.2 below. This was adapted from Wood et al., 1976 and Wood et al., 1978 and the scale was reduced to four levels of instruction in this study.

Level 1: General verbal encouragement. "Well done", "keep moving your hands", "that's better".
Level 2: Specific verbal information regarding the rowing cycle. "sit up, what effect does this have on your stroke?", "push with your legs, can you feel the pressure increase?"
Level 3: Hand-on instruction. Actually holding the hands on the blade or holding the back firm while the boy takes the stroke.
Level 4: Demonstration. To demonstrate an operation within the rowing cycle.

Table 3.2: Levels of instruction

Level 3 in Wood and Middleton's scale (mother indicates material) was left out since the boys where already familiar with the equipment.

Two measures of scaffolding were used in this study: (i) the proportion of coaching interventions that were in the region of sensitivity and (ii) the proportion of coaching interventions that were contingent. These two measures were also adopted and adapted from Wood and Middleton (1975).

The region of sensitivity was defined as the level just below the least structured one that showed clear indications of predominant success by the boys; for example, a boy that usually succeeded with intervention level 3 and below, but failed at most interventions at level 2 and above, would have his region of sensitivity defined at level 2.

The proportion of coaching interventions that were within that region of sensitivity was calculated. (a coach employing scaffolding should lie within that region). The proportion of intervention that, were contingent was also calculated. After each intervention by the coach, I recorded whether the child succeeded or failed. I then noted the next level of intervention by the coach. From this, I calculated the number of times the coach followed the rule: if the boy succeeds offer less help when next intervening, if the boy fails offer more help.

3.2.3 The Task

The task is the development of the four fundamental areas of the basic rowing stroke; recovery, catch, drive and release. A brief description of these elements, are described below.

i) Recovery

The hands lead between strokes. Push them away from the body briskly. As the arms near full extension, lean forward from the hips. Once the arms are extended and the body is leaning forward, bend the knees and roll the seat up the slide.

The blade is turned or 'feathered' at the beginning of the recovery. Once starting to roll up the slide, begin to 'square' the blade for the next stroke. The blade should stay close to the water throughout the recovery.

ii) Catch

The shins are nearly vertical. The blades are inches from the water. Complete the recovery with a slight lift of the arms to 'lock' the blades in the water.
The arms and the back remain in the same extended position at the catch. At all times the fingertips are wrapped lightly around the oars.

iii) Drive

During the power portion of the stroke 'hang' the weight from the oar handles. That means starting the drive with the legs, while holding the back and arms firm. As the legs approach full extension, leaning back towards the bow is essential and 'drawing' with the arms is required.

iv) Release

The oar handles should just brush the lower ribs at the end of the stroke. The handles are then pushed down slightly to clear the blades from the water as their pushed away from the body. Push 'down and away'.

Always keeping the hands relaxed so the handles can roll along the fingertips into a 'feathered' position. Never slouch at the finish and always keep the body firm but relaxed.

3.2.4 Equipment

A brief description of the equipment - 'ergo', rowing tank, tub and racing boat- will be described below. Each piece of equipment is used at various stages of development, and it is hoped that the boys' will progress quite quickly through the 'rowing tank' and 'tub' stage.

i) Ergo

The ergometer is a general term to describe an exercise machine. The rowing 'ergo' is used frequently by all levels of development, from the novice to the Olympian.

It is valuable to the beginner, in particular, because it allows the coach to hold on to the individual and guide them through the stroke, demonstrating exactly what is required of them to carry out the movements. It also helps to evaluate progress as well as technique without the problem of boat movement.

ii) Rowing Tank

This is really the first time that the boys get a chance to row, without actually moving. The 'tank' is much like a swimming pool, where the boys sit along an isle, so the coach can walk up and down and give instruction. Demonstration is very important at this stage, since it resembles rowing without the moving boat.

iii) Tub

This is the first time the boys go on the water. The 'tub' is a large clinker built boat that is wide enough for the coach to stand up in and to walk to the boy.

The boat is thus difficult to capsize, which gives the boys' confidence to take strokes. Demonstration is again crucial at this stage. The oars are usually made of wood and are relatively heavy.

iv) Racing Boats

This type of boat is light and fragile. The boys' finally reach this stage when they are confident of taking strokes. The boat requires good technique and skill to move and is adjustable to the needs of the crew. The oars are carbon fibre and are very light.

3.3 Results

The first aim of the study was to examine whether the coach was using scaffolding. Table 3.3 shows the number of interventions the coach made for each of the twelve boys and the proportion of those that were in the region of sensitivity and the proportion that were contingent. The difference in the pre-to-post tests was typically a shift of 1 or 2 levels. However, a shift of 4 levels indicated that huge improvements were, gained by the boys. The 'weaker' had smaller shifts in levels. The eighth boy had the most number of interventions and yet, there was still a low shift in level, from the pre-test to the post-test. That said, the coach did not appear to be sensitive to the boy's needs; hence the lower percentage within the region of sensitivity and percentage of contingent tutoring. The region of sensitivity and contingency percentages, were similar to that of Wood et al. (see appendix C)

The proportions are comparable to those reported by Wood (Wood & Middleton, 1975) and Pratt in their studies of parents instructing children, suggesting that the coach in this study used scaffolding as much as parent when instructing their own children.

Number of Interventions	% Region of sensitivity	% of Contingent Shift	Pre- to Post-test Difference Recovery	Pre- to Post-test Difference Catch	Pre- to Post-test Difference Drive	Pre- to Post-test Difference Release
5	40	60	2.00	2.00	3.00	2.00
4	50	50	1.00	2.00	1.00	2.00
3	67	67	2.00	2.00	4.00	2.00
8	50	25	1.00	1.00	1.00	2.00
6	25	33	1.00	2.00	1.00	3.00
5	30	40	2.00	2.00	3.00	1.00
7	42	14	1.00	3.00	1.00	3.00
10	30	30	1.00	1.00	3.00	3.00
3	33	60	2.00	2.00	4.00	2.00
2	50	50	2.00	3.00	4.00	3.00
4	40	50	2.00	2.00	1.00	2.00
4	40	50	1.00	3.00	3.00	2.00

Table 3.3: Contingency, Region of Sensitivity and Pre- to Post-test Scores (see appendix C)

The second aim of the study was to examine the relationship between the region of sensitivity in session 1 compared with session 5. Table 3.4 shows that the region of sensitivity (for 12 boys) used by the coach has been reduced significantly between session 1 and session 5 ($t(10 = 11.5, p < 0.05)$. This finding show that the level of instruction is less structured between sessions 1 and sessions 5. In other words, as the children were progressing, the coach was less explicit with his instructions.

Level of intervention at session 1	Level of intervention at session 5
4	1
4	2
3	1
3	1
3	2
3	2
4	1
4	2
4	2
4	2
4	2
4	2

Table 3.4: Region of Sensitivity in Sessions 1 and Sessions 5.

The third aim of the study was to examine the relationship between the pre-test scores and the region of sensitivity.

Table 3.5 shows the correlation between the region of sensitivity and pre-test scores. There is a significant and positive relationship between the region of sensitivity and the pre-test assessment of the boys' performance on the 'recovery' and 'catch' elements of the stroke, which shows that the coach was more explicit with his instruction to the less able boys than he was for the more able boys. Instructions became more technical as the boys' progressed. At this early stage, all were novices, but some coped better than others with the basic stroke and were able to continue without interruption, while the 'weaker' boys required more intervention, hence the differences in correlations.

Pre-Test Scores	Region of Sensitivity
Recovery	0.5*
Catch	0.91**
Drive	0.28
Release	0.29

*p < 0.01 ** p < 0.05

Table 3.5 Correlation between Region of Sensitivity and Pre-test Scores

The fourth and final aim to examine the relationship between learning, as measured by pre- to post-test scores and measures of scaffolding. Table 3.6 shows the correlation between pre- to post-test difference scores and the number of interventions; pre- to post-test difference scores and the proportion of interventions in the region of sensitivity and pre- to post-test difference scores and the proportion of interventions that were contingent. However, it was difficult to establish whether the coach was instructing within the region of sensitivity. This required hours of careful observation and studying of the video-tapes to establish this. That said, knowing the coach and the nature of the activity, this helped to establish some degree of accuracy of what was being said and taken to be contingent instruction.

Pre- to Post-Test Difference Scores	Number of Interventions	Contingency	Region of Sensitivity
Recovery	-.639*	.685*	.172
Catch	-.592*	.128	.124
Drive	-.432	.618*	.155
Release	.300	-.416	-.091

*p < 0.01

Table 3.6 Correlation between pre- to post-test gain scores and the Region of Sensitivity and Contingency measures.

Interestingly there was a significant and negative correlation between the number of interventions and the recovery and catch part of the stroke. Indicating that gains in pre- to post-test scores, were negatively related to the amount of tutoring interventions. As the boys improved, there were less explicit instructions from the coach. There was also a significant and positive relationship between the proportion of interventions that were contingent and pre- to post-test gains in the recovery and the drive parts of the stroke. (see appendix D)

3.4 Discussion

Much of this study has been based on the usefulness of the Wood and Bruner (1976) scaffolding concept across the four elements of the rowing stroke. The first aim of the study was to investigate whether the coach was employing scaffolding. The coach showed levels of scaffolding comparable to the Wood and Middleton (1975) study.

The proportion of interventions that were in the region of sensitivity in this study ranged from 25% to 67 % compared to Wood & Middleton's (1975) study which ranged from 0% to 60%. Similarly the proportion of interventions that were contingent ranged from 14% to 67% in this study compared to Wood & Middleton's study, which ranged from 0% to 84%. So this study showed that the coach used scaffolding and was sensitive to the boys' capabilities.

The second aim of the study was to investigate whether the level of instruction in the region of sensitivity was greater in the first session than the last session. Scaffolding theory would predict that the level of instruction would be greater during the first session than the level of instruction in the fifth session. In most cases the level of intervention has gone from specific demonstration to verbal encouragement. There was some evidence of swing between the levels, but because of the narrowing of coaching levels as the task proceeded, these became fewer in frequency. The coach clearly responded to the boys' improvements over the rowing cycle.

There was a significant decrease in the level of instruction from session 1 to session 5. The level of instruction in session 1 was 3.67 and 1.76 in session 5.

The third aim of the study was to examine whether there was a positive relationship between the level of instruction in the region of sensitivity in session 1 and the boys initial level of ability as measured in the pre-test. The study found that there was a positive and significant relationship between the level of instruction in the region of sensitivity and the recovery and catch elements of the stroke. This finding shows that the coach was sensitive to the boys' level of ability for these aspects of the stroke and also supports Wood's scaffolding theory.

The fourth aim of the study was to investigate whether there was a positive relationship between the proportion of the coach's interventions in the region of sensitivity and learning to row (measured by pre- to post-test difference scores) and also whether there was a positive relationship between the proportion of coach's intervention that were contingent and learning to row. There was no significant relationship between the proportion of interventions that were in the region of sensitivity and learning to row, but as predicted there was a significant and positive relationship between the proportion of interventions that were contingent and learning to master the drive and the recovery elements of the stroke. The result of this study showed that, the coach was contingently instructing the boys on the rowing tank. The coach was focusing on the individual within a single environment. This allowed him to prepare accurately, the required outcome of the session, without worrying about any disruptions.

One problem with this study was the low inter-reliability score for assessing the boys rowing ability in particular there was a problem with reliability on the 'release' for both pre and post-tests. This part of the stroke is very difficult to achieve. Novices tend to get their oar caught in the water ('catching' a crab) because they are unable to push their hands down at the finish of the stroke. Some get their oars out by not 'drawing' right back to their body, thus appearing to be 'clean', while others wrench their oar out of the water.

There are many things the coach needs to consider when deciding to score the boys efforts. However, this is a minor problem, which can be easily overcome. The inter-rater reliability for 'recovery' also requires some attention. Again, this aspect of the stroke is difficult to achieve. Novices rush up and down the 'slide' without allowing the boat to 'run' beneath them. The reliability for this aspect of the stroke could be improved by giving the coaches more explicit details of what to look for in a rowing stroke. How a coach interprets an action will vary considerably; therefore, having certain criteria to observe, will improve reliability.

Another limitation of this study was that there was no measure of validity for the assessment of the boys rowing ability. In the next study a number of measures of validity could be used. One would be to get another coach to assess the ability of the boys using their own measure of assessment. Another measure of validity would be to explore the relationship between these measures of the boys rowing ability and the how they perform in a rowing regatta. The expectation would be that those boys assessed highly by the coaches should perform better in a rowing competition.

A further limitation of this study was there was no inter-reliability analysis with the assessment of the proportion of interventions assessed to be in the region of sensitivity and the proportion of tutoring interventions that were assessed to be contingent. A future study will need to check the reliability of the contingency measures and the region of sensitivity measures.

One important and interesting aspect of this pilot study, is the physical environment. The environment had a crucial affect on the coach's ability to continently instruct. The affect of coaching one boy, will affect how the other boys perform within the crew. The coach is fully aware of this and tends to make more general comments to the crew so that they all think about the same aspects of the stroke. The group situation thus makes contingency difficult to instruct. That said, the coach did try and isolate individual problems. This is where this study extends Wood's notion of scaffolding, because it looks into group situations, rather than one-to-one interactions.

This chapter looked at scaffolding and contingency tutoring in learning to row. It investigated twelve boys in a single environment; the rowing tank. It found a significant relationship between contingent tutoring and learning to row. Chapter 4 hopes to replicate and extend this study, with the introduction of the 'ergometer' (another land based activity) and the rowing boat (outside).

Chapter 4: Scaffolding and learning to row in different learning environments

4.1 Introduction

This chapter hopes to replicate the findings from Chapter 3 and investigate the relationship between contingent tutoring and the acquisition of rowing. This chapter will also examine scaffolding in three different learning environments for teaching rowing. These environments include the 'ergometer' , 'rowing tank' and the 'boat' work on the river. Each of these activities takes place in different environments and contexts; which are all part of rowing development. All these contexts differ from the more conventional one-to-one mother-child relationship or one-to-one tutor-child with a disability. Rowing is not a classroom activity, nor is set in a formal environment with young children. This study is conducted with more grown up children in a naturalistic context, and more importantly, in two groups of 8 boys working together. The study has four aims.

The first aim was to examine whether the coaches were using scaffolding. Are coaches employing scaffolding in an informal group based teaching situation? The theory of Scaffolding predicts that with time, the student will become more proficient as the coach provides instruction within the Region of Sensitivity. The second aim was to examine whether there was a relationship between scaffolding and learning to row. The third aim is to investigate whether there is a negative relationship between the Region of Sensitivity and the boys' initial level of ability. Scaffolding theory would predict that the level of instruction would be more explicit the lower the level of ability of the child. The fourth aim was to examine whether scaffolding was dependent on the environment.

4.2 Method

4.2.1 Participants

The study employed sixteen boys and three coaches. The boys were 13-14 year olds from an independent school in South West London. They are all from middle-class families who volunteered to row as part of their School curriculum. The boys in this study had been rowing for some time and although they were still novices, they had more knowledge of the sport. The equipment was the same as the initial study, to help with consistency. One of the coaches was a teacher, one was the School's boatman and the third was a part time helper, who was an 'old boy' of the school. All the parties involved, were still happy to be observed.

4.2.2 Procedure

The boys were seen individually and collectively in a crew (a boat of eight) and their instruction sessions were recorded on videotape. All the boys volunteered to row and agreed to be filmed, since it would be used as a teaching aid.

When the boys first saw a rowing boat, they were invited to touch the hull and to feel the weight of the oars. They had little idea about the make of equipment. Then they moved to the rowing tank and were given a demonstration by the coach. Each boy was given 5 minutes to 'play' around and feel for the nature of the task.

They were then be given a pre-test on the four basic elements of the stroke which were the recovery, the catch, the drive and the release. Each boy was assessed on these four elements with a score that would range between1 to 10. At the same time the boys were tested on the ergo as a validity check.

After the pre-test there were three sessions approximately a week apart. All the sessions were videotaped. The first session was in the tank, the second was on the ergo and the final session was on the boat. These sessions lasted between one to two hours . All the boys were accompanied and coached by the tutor on the development of their basic rowing stroke.

The Post-test immediately followed the last session and was the same as the pre-test. The reliability of the pre- and post-tests was be verified by another coach using the same observation schedule. Inter-rate reliability scores were calculated between myself and the other coach on the four elements of the stroke. They are shown in table 4.1.

	Pre-Test (n=16)	Post-Test (n=16)
Recovery	0.77	0.91
Catch	0.56	0.82
Drive	0.45	0.91
Release	0.76	0.96

Table 4.1: Inter-rater reliability for the four elements of the stroke.

This showed that there was a low relationship for the 'catch' and 'drive'. It was assumed that both coaches had the same view of those technical points. The 'catch' could be achieved by pushing the legs at the front of the stroke or by lifting the body, thus throwing the oar into the water. The 'drive' on the other hand depended on the 'catch'. A good leg drive depended on how well the oar was placed into the water. However, these problems were discussed and sorted out. It was felt that there was no need to carry out another reliability test. Both coaches were satisfied that they were looking out for the same technical points.

The videotapes of session 1 and 5 were analysed to 'measure' scaffolding. The level of intervention was assessed using table 4.2 below. This was adapted from Wood et al., 1976 and Wood et al., 1978.

Level 1	General verbal encouragement. "Well done", "keep moving your hands", "that's better".
Level 2	Specific verbal information regarding the rowing cycle. "sit up, what effect does this have on your stroke?", "push with your legs, can you feel the pressure increase?"
Level 3	Hand-on instruction. Actually holding the hands on the blade or holding the back firm while the boy takes the stroke.
Level 4	Demonstration. To demonstrate an operation within the rowing cycle.

Table 4.2: Levels of instruction

Two measures of scaffolding were used in this study: (i) the proportion of coaching interventions that were in the region of sensitivity and (ii) the proportion of coaching interventions that were contingent.

The region of sensitivity was defined as the level just below the least structured one that showed clear indications of predominant success by the boys; for example, a boy that usually succeeded with intervention level 3 and below, but failed at most interventions at level 2 and above, would have his region of sensitivity defined at level 2. The proportion of coaching interventions that were within that region of sensitivity was calculated. (a coach employing scaffolding should lie within that region). The proportion of intervention that were contingent was also calculated. After each intervention by the coach, we recorded whether the child succeeded or failed. We then noted the next level of intervention by the coach. From this, we calculated the number of times the coach followed the rule: if the boy succeeds offer less help when next intervening, if the boy fails offer more help.

4.3 Results

The first aim of the study was to examine whether the coach was using scaffolding in his teaching. Table 4.3 below shows the number of interventions made by the coach for each boy and the proportion of those that were within the region of sensitivity, and those that were contingent. The first column shows the raw number of interventions by the coach from all three learning environments. The percentages for the region of sensitivity and percentage of instructions that were contingent were calculated from these interventions, taken from the video session.

(Raw data see appendix E)

No. of Interventions	% Region of Sensitivity	% Contingent shift
39	51.3	44.8
40	55.0	45.4
39	53.8	46.4
33	55.4	41.5
34	55.9	37.6
43	53.5	48.6
32	53.2	35.8
34	55.9	37.6
37	56.8	40.5
40	55.0	47.3
57	63.1	63.3
36	47.3	38.1
34	44.1	43.1
36	50.0	44.0
35	57.1	42.0
39	59.0	44.1

Table 4.3 Number of Interventions by the coach

It can be seen that the coach was instructing within the boys' region of sensitivity (44.1< R of S<63.1). Three quarters of the interventions made, were above 53%. However, the same coach was less successful at responding at a contingent level (35.8<Con<63.3), only a sixteenth of the time above 53%.

The second aim of the study was to examine the relationship between the region of sensitivity in session 1 compared to the region of sensitivity in session 5. Table 4.5 below shows the region of sensitivity used by the coach had reduced significantly between the sessions. These levels were drawn form table 4.2 and coded from the video session.

Pre-Test	Post-Test
3	1
4	2
3	1
4	2
4	1
4	2
4	2
4	1
4	2
4	2
4	3
3	1
4	1
4	2
4	1
4	2

Table 4.5 Region of Sensitivity at Pre and Post-Test

This shows the level of instruction was less structured between session 1 and session 5. In other words, as the boys were improving, the coach was using less explicit instructions.

The third aim was to examine the relationship between learning, as measured by pre-test to post-test scores and measures of scaffolding. Table 4.6 below revealed some very interesting results.

Pre- to Post-Test Difference Scores	Number of Interventions	Contingency	Region of Sensitivity
Recovery	-.650*	-.336	-.624*
Catch	-.303	-.134	-.267
Drive	-.340	-.074	-.278
Release	-.700*	-.332	-.604*

Table 4.6 The relationship between the pre-test scores and the region of sensitivity.

It shows a significant relationship between the pre-test to post-test scores. Firstly, the proportion of interventions in the region of sensitivity and secondly, the differences of proportion of the interventions that were contingent. The results show an opposite relationship to what was expected, which is the more the coach used scaffolding, the less the boys made any progress. Each aspect of the stroke in relation to the number of interventions and the use of scaffolding showed a negative outcome.

The fourth aim was to look at the varying environments (see table 4.7). This is a very important aspect of scaffolding, which if mentioned, is only glossed over. The mean level of interventions using a paired sample t-test show a significant difference between the tank and ergo, ($t(15) = 2.05$, $p < 0.06$) between the ergo and boat, ($t(15) = 11.4$, $p < 0.050$) and the tank and boat ($t(15) = 9.6$, $p < 0.05$). The number of interventions, varied according to environments; the tank and ergo being on dry land allow the coach to get closer to the boy and demonstrate, stop and instruct far more easily than the boat.

The mean level of interventions, were calculated for each boy at each level and then for the overall mean for that environment. (Raw data see appendix E). Apart from having means for each level, there were means for each of the three 'learning environments'. These calculations revealed that both the land-based activities had a similar relationship to the water-based activity.

The physical nature of the boat, does not allow the coach to get close to the individual boy, thus having to resort to generalised comments.

Mean Level of Intervention

Boat	Ergo	Tank
2.40	2.64	1.80
2.54	2.45	1.81
2.55	2.45	0.76
2.57	2.45	1.93
2.58	2.63	1.79
2.44	2.85	1.86
2.40	2.44	1.77
2.40	2.45	1.92
2.40	2.64	1.85
2.27	2.47	1.57
2.47	2.48	2.00
2.40	2.46	1.54
2.40	2.45	1.77
2.58	2.45	1.77
2.40	2.58	1.62
2.43	2.58	1.77

Table 4.7 Level of Intervention in Different Environments

Looking at the Region of Sensitivity in relation to the environment, it can be seen that there is a significant difference between the land based activities and the water (see Table 4.8). (Raw data see appendix E)

% Region of Sensitivity		
Boat	Ergo	Tank
40.00	50.00	70.00
43.80	72.70	53.80
35.30	81.80	54.50
46.70	57.10	71.40
42.90	75.00	58.30
35.70	69.20	56.30
38.50	66.70	60.00
46.20	63.60	60.00
38.50	64.30	70.00
42.90	60.00	63.60
41.20	71.40	73.60
38.50	46.20	60.00
30.80	54.50	50.00
38.50	54.50	58.30
46.20	58.30	70.00
53.80	66.70	57.10

Table 4.8 Region of Sensitivity in different environments

Using paired sample t-tests there is a significant difference between the ergo and the boat ($t(15) = 8.1$, $p < 0.05$) and the tank and the boat ($t(15) = 10.8$, $p < 0.05$). There is no difference between the tank and the ergo. Both land activities show a similar relationship to the water based activity. The Region of Sensitivity is clearly affected by the nature of the environment and the conditions it was carried out in.

The same relationship between land based activities and water based activities remain for the percentage of interventions that were contingent (see table 4.9). (Raw data see Appendix E)

% Contingent Shift		
Boat	Ergo	Tank
46.70	57.10	80.00
50.00	72.70	69.20
47.10	90.00	63.60
53.30	81.80	85.70
42.90	87.50	66.70
42.90	76.90	62.50
46.20	66.70	70.00
53.80	72.70	60.00
46.20	71.40	70.00
50.00	73.30	72.70
47.10	80.90	78.90
38.50	53.80	60.00
46.20	63.60	60.00
53.80	63.60	66.70
53.80	75.10	80.00
61.50	75.20	64.30

Table 4.9 Contingency in different environments

Using paired sample t-tests there is a significant difference between the ergo and the boat ($t(15) = 9.1$, $p < 0.05$) and the tank and the boat ($t(15) = 9.6$, $p < 0.05$). There is no difference between the tank and the ergo.

4.4 Discussion

Study 2 was based on the usefulness of Wood and Bruner's (1976) concept of scaffolding, across four elements of the rowing stroke. The first aim was to examine whether the coach was using scaffolding in his general coaching. The coach showed levels of scaffolding that were comparable to Wood and Middleton's (1975) study. The proportion of interventions that were in the region of sensitivity ranged from 44.1% to 59%, compared to Wood's study, which ranged from 0% to 60%.

Similarly, the proportion of interventions that were contingent ranged from 35.8% to 63.8%, whilst Wood's study ranged from 0% to 85%. Study 2 shows that the coach used scaffolding and was sensitive to the boys' capabilities. It had a smaller range than Wood and Middleton's study because all the boys were complete novices when they were introduced to rowing, so they had similar abilities from the beginning. The coach may have been focusing on the weaker boys.

The second aim was to investigate the sort of relationship that was established between the coaches' intervention in the region of sensitivity and learning to row, and whether this relationship was contingent. Study 2, unlike the study 1 found a negative and yet significant relationship. The more contingent the coach, the less the student improved. Similarly the more the coach operated within the region of sensitivity the less the student improved. The main difference between the two studies, is that, study 1 used only one environment (tank) to carry out the investigation; whereas study 2 on the other hand, introduced the 'ergo' and the boat to make its comparisons.

Whilst using one environment, the number of coaching interventions within the region of sensitivity and contingency, showed some positive relationships. However, employing the same methods and approach to two additional environments, a negative relationship was found. This negative relationship was due to the fact that two new 'learning environments' were introduced to the coaching session. The coaches were also different from the earlier study. The 'group' of boys would either go rowing or stay inside on the tank or ergometer, but this depended on the water conditions and what the coach could

achieve during that session. A more important factor could be related to the order in which the environments were looked at. This of course depended on the river condition, the time of the session and the physical state of the crew. On a particular day the coach may decide to go rowing, but this could be shelved because the river conditions are too dangerous. Under these circumstances, the coach will need to reassess the situation and do something else. The 'order' in which the study is carried out, may not always be determined by the coach. This 'order effect' may help to explain the negative relationship.

The third aim was to investigate whether there was a negative relationship between the coaches' initial level of instruction within the region of sensitivity and the student's initial level of ability. The study found that the level of ability of the boys was negatively and significantly related to the level of instructions the coaches used initially. Thus the coaches were more explicit in their instructions to the less able students. One would expect this result, since the amount of instruction would decrease as the boys made progress and more technical language would be used. The coach would then shift his approach to more observation and making fewer remarks to the 'crew'. As the 'crew progresses, there is a shift by the coach from direct intervention to more observation.

The fourth aim looked at scaffolding with varying environments. It found that there were significant differences between the ergo and tank, ergo and boat and the tank and boat. Environmental change had a significant effect on this study. There are a number of possible reasons for this.

On dry land, the coach can get up close, make specific or general instructions and can also get physically involved, with 'hands on' coaching and demonstration. Land based activities create a safe environment to work in; the tank and ergo are stable, there is no fear of falling into the river or getting wet, irrespective of the weather outside. The boys are able to coach themselves, as well as others; they have mirrors on the walls to help with technique, a wall in the water to prevent the blade from 'diving' (digging too deep), and holes in the blades, to allow the water to pass through. By contrast, on the water, the

coach is unable to get 'hands on' directly, thus limiting demonstration, and coaching tends to be more generalised. Water conditions affect the stability of the boat and the length of the outing. (rough water, generally means a short outing)

Another interesting finding was the negative relationship between the use of scaffolding and learning to row. This finding was opposite to what was predicted and opposite to the finding reported in the previous study. One possible explanation for this difference between the two studies was that the coaches were different in this study. The coaches could have been focussing on the wrong points, not differentiating between the ability of the boys, and spending a disproportionate amount of time with individuals. Another possibility is that the coaches were using the wrong resources, with inappropriate equipment. Lack of expertise, motivation and ability of the coaches can also have a bearing on the outcome. One coach in particular, is still young and inexperienced who is still learning; he may not have real empathy with the boys.

The boys in this study, have made sound progress, and are no longer novices. Now they are able to work things out for themselves the basic technical points. The 'new' coaches are introduced to the boys, thus starting to coach them from a different starting position. This requires a different approach to coaching raw novices, and the boys need to adapt to the new coaching style.

The 'negative' effect may partly result from the fact that the coach is looking at a group of boys in different environments and not just a one-to-one situation, with a familiar environment. Previous studies have made little or no reference to the nature of physical environments. Can scaffolding and contingency be effective in group situations? This is very difficult to establish while there are conflicting environments to contend with.

Another interesting finding was the difference between the different environments and scaffolding. Not surprising, was the relationship between land based activities and the 'boat' sessions. The 'ergo' and 'tank' sessions revealed a similar relationship to the 'water' session. The 'ergo' and 'tank' allow the coach to demonstrate and position the

boys in the correct technique without fear of floating down the river or falling into the water. The boys can concentrate on the coach without worrying about being tangled up with other crew members and clashing blades.

However, the problem manifests itself when the crew takes to the water. 'Hands on' (level 3) rarely exists and 'demonstration' (level 4) plays a small part in the coaching technique. Instructions then, become general (level 1) and specific (level 2). This form of coaching is determined by the context in which the activity is found in. Study 1 did not have this problem, all the range of instructions were used. Study 2 however, found itself being limited to instruction levels 1 and 2.

There were many positive elements to study 2. Firstly, the inter-reliability scores were similar to Wood and Middleton's (1975) study, ranging from 68% to 79% for the four elements of the rowing stroke. Secondly, was the validity score of 69% close to the other studies. There is a positive indication, that the coaches were using scaffolding. Rowing is a difficult action to control, it is continuous and many external factors such as balance and timing affect the actual movements. Concentration is an important factor in carrying out an effective stroke.

What is more important is the fact that each boy has to rely on another member of the crew to do his bit. Each individual boy working separately has to be aware of the rest of the crew in order to form a cohesive unit. Thus, individuals have to work as a group. It has been mentioned that oarsman have one thing on their minds; if that.

Rowing development is not a linear progression; a boy does not make improvements from one outing to the next. There is usually a period of no progress, and then suddenly he is able to do what is asked of him. This stop/start process goes on for a long time, rather than a gradual improvement.

The main findings from this study, is that the three 'learning environments' were looked at with 'individuals within a group', who have been rowing for almost a year. The nature

of rowing, is to teach a 'group to act a single unit', hence, the shift from direct instruction to making generalised comments through observation. Scaffolding and contingent tutoring become less important for the coach at this stage of development.
What emerges at this point, is that, the coaches' views must be taken into consideration; their ideas become more important, rather than their ability to scaffold or tutor contingently.

This chapter did not replicate the finding from the study reported in chapter 3 that contingent coaching was positively related to learning to row. Thus it was decided to have a much broader investigation of coaching, by not just focusing on contingent tutoring but examining the strategies coaches use in coaching rowing. It was also decided to further investigate how different environments influence the coaching strategies of the coaches. Thus, Chapter 5 investigates the different coaching strategies employed by the coaches and if this differed depending on the environment.

Chapter 5: Coaching In Different learning Environments

5.1 Introduction

Chapter 4 found contrary to chapter 3 that contingent tutoring was not positively related to learning to row and also that the type of environment influenced the style of coaching. This chapter is an observational study of rowing coaching in different settings with different coaches. It has three main aims.

The first aim was to examine the coaching activity in coaching rowing. The study will investigate the different strategies.

The second aim was to compare the coaching style of different types of coaches. The two coaches observed in this study have different backgrounds. One coach is a more experienced teacher who has the knowledge and skill that the other needs to develop. The other had just started coaching rowing and is unfamiliar with the latest educational theories and teaching techniques. Both the coaches are looking at using the three different type of learning environment. (ergometer, tank and rowing). It is expected that the coaches will have very different coaching styles and use scaffolding to a lesser or greater extent.

The third aim was to examine whether the functions of scaffolding were dependent on the learning environment. The physical nature of the environment is an important factor in coaching. There are a number of different learning environments used in coaching rowing. These include a rowing tank, a rowing ergometer and a number of boats on the river. With the ergo and the tank, the coach has an ideal opportunity to get very close to the activity with 'hands on' instruction and demonstration. The boys feel safe, there is no chance of falling off, or getting tangled with the blade, or worrying about the balance. The river, however, is less stable, with a much greater chance of catching a 'crab' and losing the blade. The coach cannot get up close to get 'hands on' and he has to coach from a motor launch. These different environments it is expected will influence the type of coaching activities observed.

5.2 Method

5.2.1 Participants

i) Boys

The study employed sixteen boys and three coaches. The boys were 13-14 year olds from an independent school in South West London. They are all from middle-class families who volunteered to row as part of their School curriculum.

ii) Coaches

There are two coaches being looked at in this study, Nick and Tony. Both are coaches employed by the School to develop rowing and race boys to a high standard. However, both have different backgrounds.

Tony is a much older man, who has taught for many years. He has a History degree and a PGCE from a university in New Zealand. He has also been rowing since he was a boy and reached a very high standard. He represented New Zealand in a number of World Rowing Championships and achieved a Gold Medal as a senior. He has been coaching for many years in London; juniors as well as seniors and has developed expertise in schoolboy rowing.

Nick by contrast, is an Old Boy of the School, once coached by Tony. Nick has set his mind to becoming a rowing coach and has been coaching for a relatively short time. He is very familiar with Tony's procedures and coaching style, but lacks the knowledge of teaching in a more formal setting. Nick also took part in the previous study, but Tony did not. Both were delighted to help with the study and saw it a way of maintaining interest and focus for the boys.

5.2.2 Procedure

The boys were seen individually and collectively in a crew (a boat of eight) and their instruction sessions were recorded on videotape. All the boys volunteered to row and agreed to be filmed, since it would be used as a teaching aid.

When the boys first saw a rowing boat, they were invited to touch the hull and to feel the weight of the oars. They had little idea about the make of equipment. Then they move to the rowing tank and were given a demonstration by the coach.

All the sessions were videotaped. The first two session were in the tank, the next two were on the ergo and the final two sessions were in the boat. Six sessions in all were videotaped, and each lasted between one to two hours. All the boys were accompanied and coached by the tutor on the development of their basic rowing stroke.

5.2.3 Analytic Framework

The coaching was analysed using the following categories. These categories were developed from watching the videotapes of the rowing coaching and partially based on the categories used by Wood et al., (1978) in his study of scaffolding.

i) General verbal encouragement

This type of instruction is used throughout the coaching of rowing; novices and experienced crews. The amount of general encouragement varies from coach to coach and they tend to be in the form of, "Well done", "That's better" and "Good work". This type of instruction does not expect a response, it is something which naturally part of coaching. It uses simple language, with no technical terms until they have a little more experience.

ii) Specific verbal instruction

This type of instruction is much more related to the action of the rowing stroke. Technical language is now used more often, and comes in the form of, "Drive your legs", "How does this affect the run of the boat?" "Allow the boat to run".

All coaches used instruction to varying degrees. The 'crew' tends to more informed about the nature of rowing and it's technical requirements. Instructions of this nature elicit a greater response than before, but it is not exclusive. Individual crew members respond if they are unsure of what is required, or if they need reassurance or feedback.

iii) Demonstration

Demonstration uses technical language as well as verbal encouragement. Demonstration normally takes place where the coach can get close up to the individual, so the 'ergo' and the rowing 'tank' are ideal contexts for this to take place. Most coaches use this form of instruction to help novices to row; it helps with the visualisation of the stroke, which gives the novice an idea of what is expected of them.

iv) Questions

Questions from the students, is an important process which takes place in any teaching environment. However, unlike other teaching contexts, rowing has a culture whereby the crew and its members remain quiet while they are actively engaged with the rowing stroke. There are two main reasons for this, firstly, for safety reasons, they have to be able to listen to the coach in case of any danger, and secondly, they need to be able to listen to the coxswain for technical coaching and general organisation. Either way, the crew must be in a position to hear the coach or the coxswain. Nevertheless, coaches do expect some interaction between their crews in much the same way as a classroom teacher receiving an answer to a question. How are these questions structured?

v) Free time

This is an important part of rowing. It gives the individuals and crews an opportunity to practice their rowing action without anybody looking over them. They are in a position where they feel more relaxed and less pressured to perform. They begin to experiment and try out things they would otherwise not do, and to discuss their technique or problems with each other. As the crews become more experienced, they begin to coach themselves, and it is a valuable aspect of learning to row.

vi) Scaffolding

The notion of scaffolding derives from Wood and Middleton's (1978) study. The measures of scaffolding used in this study looked at the proportion of coaching interventions that were in the region of sensitivity. The region of sensitivity is defined as the level just below the least structured one that, showed clear indications of predominant success by the boys.

The coaching was also analysed in terms of the number of boys each coaching activity was addressed to. This was broken down into three self-explanatory categories all of the boys, one of the boys and some, which was not all the boys and more than one boy.

5.3 Results

This observational study looks at two coaches, coaching 16 boys and their relationship to their coaching environment (for the full observation notes see appendix B). It was through watching the video-tapes, that the boys' behaviour were classified into various categories. This was extremely difficult to achieve with only one person studying the tapes. However, using the seven points from the analytic framework, one was able to time and calculate the number of incidences with a stop- watch (hour, minutes and seconds). There were some ambiguous situations, where the some incidences were competing for the same code. An informed judgement had to be made in these circumstances.

5.3.1 Type of Coaching Activity

The first aim was to investigate the type of coaching activity involved in coaching rowing. Table 5.1 looks at the time spent on each coaching activity and the number of interventions by the coach. This shows that the boys at this stage are competent oarsmen and that scaffolding and contingency tutoring, play a small part in teaching and learning to row.

From Table 5.1, it can be seen that the most of the time is spent giving general instructions – 1 hour 34 minutes and33 seconds. Closely followed by the amount of time spent on specific instructions – a time 1 hour, 6 minutes and 58 seconds. The amount of time spent on demonstration, questions from boys, free time and observation was almost equal – 23 minutes and 43 seconds, 23 minutes and 24 seconds, 23 minutes respectively. The smallest amount time was spent on of scaffolding. This totalled 15 minutes (ie only 6% of the time) and there were only (ie only 8% of the coaching activities were scaffolding)

	Time	Number
Specific	66.9	57
General	94.5	44
Demonstration	23.7	14
Questions from boys	23.4	15
Free Time	23.0	2
Observation	22.9	24
Scaffolding	15.3	14
Total	269.8	170

Table 5.1 Time (minutes) Spent and Number of coaching activities

Table 5.2 looks at how the interventions are made by the coaches and how many boys they are addressed to. From Table 5.2, it can be seen that for specific instructions most of them were addressed to individual boys (53 of the 57). The opposite was true of general instructions. Most of them were addressed to all the boys (37 of the 44). Demonstration is an integral part of coaching rowing, and is usually carried out at the beginning of the session; especially with novices. Most of the demonstrations were given to individual boys (8 of the 14). There was only one incident where a demonstration was addressing more than one boy. Most of the observations (14 of 24) were directed to all the boys.

The amount of scaffolding totalled 14 incidences and all of them were addressed to individual boys.

	1 boy	Some	All	Total
Specific	53	2	2	57
General	2	5	37	44
Demonstration	8	1	5	14
Questions from boys	15	0	0	15
Free Time	0	0	2	2
Observation	5	5	14	24
Scaffolding	14	0	0	14

Table 5.2 Number of Boys Addressed and Coaching Activities

5.3.2 Type of Coach

The second aim was to compare the amount and type of coaching activities employed by each coach. Table 5.3 describes the amount of time spent by each coach on the different coaching activities. There were a number of differences in the amount of time the coaches spent on each activity. Nick provided more specific instructions (19.6 minutes to 3.2 minutes), and Tony provided more general instructions (22. 8 minutes to 8.7 minutes). There was little difference in the amount of demonstration.

The demonstrations in Tony's sessions were carried out entirely by the boys. Nick never used the boys to demonstrate. He did all the demonstrating. Most of the questions took place during Nick's sessions (4.9 minutes compared to 1.9 minutes). The amount of free time was left to the coaches to decide and Tony allowed greater freedom for the boys to paddle and experiment than Nick (5 minutes compared to 2.7 minutes). There was also a difference between the coaches in terms of the amount of observation. Tony observed more than Nick (24 minutes compared to 3.5 minutes). As we have already noted the amount of scaffolding was relatively small, but even with in scaffolding was a small difference between the coaches, Nick employing more scaffolding than Tony (3.1 minutes compared to 2 minutes).

	Specific	General	Demonstration	Questions	Free time	Observation	Scaffolding
				Boys			
Nick							
Tank	15.5	18.9	9.9 (8.5 Coach)	6.2	00.00	7.9	1.5
Ergo	14.4	4.5	0.6	3.8	8.8	00.00	2.1
River	27.4	2.8	2.7	4.8	7.2	9.0	5.9
Mean	19.6	8.7	4.1	4.9	2.7	3.5	3.1
Tony							
Tank	1.9	19.9	3.4	3.2	5.00	6.6	1.9
Ergo	3.9	18.5	5.8	1.7	00.00	16.9	1.1
River	3.9	30.00	00.00	3.7	10.00	48.5	2.9
Mean	3.2	22.8	3.00	1.8	5.00	24.00	1.9

Table 5.3. Time (minutes) Spent on Each Coaching Activity and Different Coaches

Table 5.4 describes the number of different types of coaching activities employed by the coaches. There was a significant difference between the coaches in terms of the activities they used in coaching (Chi-squared = 21.4, df = 5, p = 0.001). Nick employed specific instructions more than Tony (49 examples compared to 8 examples). General instructions were fairly evenly distributed between the coaches, with most of the interventions addressing all the boys.

There were 20 examples of general instruction from Tony and 24 from Nick. Similar, the amount of demonstration (for each coach) was also evenly distributed. There were 8 examples of demonstrations from Tony and 6 from Nick. The number of questions asked by the boys, were relatively few with 15 in total, with a 5 examples from Tony and 10 examples from Nick. There was also a difference between the coaches in terms of observations. There were 14 examples of Observations from Tony and 10 from Nick. Scaffolding was only a small part of coaching rowing, and this was entirely an individual activity. There were 11 examples of scaffolding observed from Nick and only 3 examples from Tony.

	Specific	General	Demonstration	Questions	Observation	Scaffolding
Nick						
Tank	19	12	5	4	6	3
Ergo	14	6	1	2	0	4
River	16	6	0	4	4	4
Total	49	24	6	10	10	11
Tony						
Tank	1	4	2	2	2	0
Ergo	2	5	5	2	3	2
River	5	11	1	1	9	1
Total	8	20	8	5	14	3

Table 5.4 Number of interventions and Different Coaches

There were also a number of differences in whom the coaches were addressing (see table 5.5). One difference was in the use of demonstration. Nick was exclusively using observation with individual boys (6 of 6), whereas Tony's used demonstrated with all the boys (5 of 8). Another difference was in the use of observation. Tony used observation

with the whole group (12 of 14), whereas Nick employed observations primarily with individual boys (5 of 10).

	Specific	General	Demonstration	Questions	Observation	Scaffolding
Nick						
All	0	21	0	0	3	0
Some	0	2	0	0	2	0
One	49	1	6	10	5	11
Total	49	24	6	10	10	11
Tony						
All	0	16	5	0	12	0
Some	2	3	2	0	2	0
One	6	1	1	5	0	3
Total	8	20	8	5	14	3
Grand Total	57	44	14	15	24	14

Table 5.5 Number of interventions and number of boys.

5.3.3 Type of Environment

The third aim was to investigate the difference between the type of environment and the type of intervention employed. Table 5.6 gives a summary of the amount of time spent on each coaching activity in each of the three different learning environments. A number of

differences were found between the three environments in terms of the amount of time spent on each coaching activity. There was twice as much time spent on specific instructions on the river compared to the other two environments. Similarly, there was more time spent on observation on the river (3:1), than the other two environments. Also there was twice as much time spent time scaffolding on the river than the ergo or the tank. There was also twice as much time spent on demonstration on the rowing tank than the other two environments.

	Tank	Ergo	River	Total
Specific	17.3	18.3	31.4	66.9
General	38.8	22.9	32.8	94.5
Demonstration	13.3	6.4	4.1	23.7
Questions	9.5	5.5	8.5	23.5
Observation	14.5	16.9	57.5	82.9
Scaffolding	3.4	3.2	8.7	15.3

Table 5.6 Time (minutes) Spent on Each Coaching Activity and Type of Environment

Table 5.7 represents the number of coaching and activities in each of the three learning environments. There was no real significance between environments in terms of the types of actions performed.

	Tank	Ergo	River	Total
Specific	20	16	21	57 (33%)
General	14	11	17	44 (26%)
Demonstration	7	6	1	14 (8%)
Questions	6	4	5	15 (9%)
Observation	8	3	13	24(14%)
Scaffolding	4	6	4	14 (8%)

Table 5.7 Learning environments and the number of different coaching activities

Table 5.8 below shows the learning environments and the number of different coaching activities. It is clear that most of the coaching interventions are directed towards the individual (98 of 168), 58%, and that most of these were during the rowing tank (42 of 60). Very few interventions were directed towards some of the boys (13 of 168), only 7.7%, and that these were mostly during rowing on the river. There is little difference between the environments when coaching all the boys, although the river encouraged more coaching towards all the boys (23 of 57). There is a big difference between the learning environments and the number of coaching interventions. Rowing tends to focus on coaching individuals.

	Tank	Ergo	River	Total
All	18	16	23	57
Some	0	2	11	13
Individual Boys	42	27	29	98

Table 5.8 Learning Environments: Number of interventions per activity.

It can be seen that there are differences in the number of coaching interventions and the different environment. Coaching focuses on individuals within a group, which makes scaffolding difficult to observe.

5.4 Discussion

Chapter 5 was an observational study of coaching rowing. The first aim was to investigate the type of coaching that goes on in rowing coaching. Most of the time was spent on making general comments, with the greatest number of coaching interventions made during specific instructions. Interestingly, the least amount of time spent on any activity was the use of scaffolding, and to only one boy. Scaffolding is difficult to find in rowing, because much of the coaching involves making general comments to individual boys within large groups and the fact that it takes place in an informal and naturalistic environment. Most of the observations taking place are directed towards all the boys, with fewer incidences to one boy or some of the boys. It is much easier to focus on all the boys when observing them to give general feedback and technical assistance. Observation also takes place during free time, when the crews can do their own thing; the boys are given freedom to discuss the outing or session without being under formal instruction. The boys are given time to talk to each other before they paddle off on their own. This is really the only time they have to talk about their rowing; otherwise, they listen to their coach in silence. (That said, the boys do have the opportunity to talk to each other and their coach after the outing.) The coach can informally look at what is going on and make more useful comments after the outing.

The second aim was to compare the two coaches. There were differences between the coaches in terms of the amount of time they spent on each activity. Nick tended to focus on individual coaching on the tank, while Tony focused on making general comments on the river in boats. There were also differences in the use of observation and scaffolding. Tony observed more, which links to the amount of free time he allowed and Nick 'allowed' more questions to be asked. The use of scaffolding was very small and Nick used the technique twice as much as Tony.

The third and final aim looks at the different learning environments e.g. ergo, tank and river. There were differences in learning environments and the amount of time spent on each activity. Twice as much specific individual coaching took place on the river, than any other environment, whilst the number of coaching interventions remained similar. This is expected, since rowing is largely based on the river. Most of the general coaching took place on the tank, with the greatest number of interventions taking place on the river. As for demonstration, there was twice as much of time spent on the tank than on any other environment, with very little intervention on the river. Observation is an important part of rowing, hence the amount of time spent on the river. Three times as much time is spent observing on the river than on any other environment. The observations last much longer, when the crews are out on the river.

The coach can study technique without saying anything to the crew, until they have finished the outing. Again, scaffolding plays a small part in coaching rowing, with twice as much time spent out on scaffolding on the river than on any other environment; whilst the greatest number of interventions taking place on the ergo. This is because the coach can get close to the individual and coach, without any other technicalities to worry about. The differences in the environment provide differences in terms of coaching and the number of interventions. One can conclude that coaching takes place on the river, with specific individual instructions.

The first study found a positive relationship between scaffolding and learning to row. This was due to the fact that it looked at coaching individuals in one environment (tank). However, when study 2 introduced two more environments, the ergos and the river, a negative relationship developed. This study also found that there was little scaffolding going on. With scaffolding playing such a small part of rowing, there must be other factors involved with coaching. Rowing is an informal activity, taking place in a naturalistic environment. Each session is different from the next. The river conditions vary enormously between outings and the skills needed are required at different times of the session. Scaffolding is not related to learning, because it forms only a small part of coaching. Joan Bliss et al (1996) argued that there is little evidence of scaffolding in most school lessons. (naturalistic-based setting). Gelman et al (1991) found that scaffolding did not occur very often in informal situations. Rowing is set in both an informal and naturalistic setting, with more than one environment to consider. This must make scaffolding difficult to achieve. The other contributing factor to this problem is that, the coach is looking at groups of boys, and at best, individuals within a group. This is similar to school based lessons, of many-to-one tutoring interactions as opposed to one-to-one in mother-child interactions.

This study found similar differences between environments and the coaches as the last study. Nick focused on specific individual coaching and Tony focused on making general comments to all the boys. Both studies found that there was little use of scaffolding in coaching rowing and learning to row. This study also supports the second study where we found differences between the coaches and difference between the environments.

Some work has gone into developing specific learning environments, but little has gone into clarifying the general issues that affect the acquisition of a complex skill-like rowing-especially in a naturalistic setting. Richard R Burton et al (1984) carried out a study of an extremely complex skiing, to determine why it has become so easy to learn. Their goal was to analyse the features of a highly successful learning environment in order to articulate the general theory of learning environments.

They argue that learning environments can be examined in terms of a paradigm called 'increasing complex micro worlds' (ICM). In this paradigm, the student is exposed to a sequence of environments (micro worlds) in which his task becomes increasingly complex. The purpose of an individual micro world is to provide the student with a task that he can perform successfully using a simplified version of the final skill in the goal. This allows the student to focus on and master one aspect of the skill in a context that requires related sub-skills. As a result, the student learns when to use the skill as well as how to use it. The purpose of the sequence, they argue, is to evolve the simplified skills towards the goal skill. The ICM framework focuses both on what is learned in any particular micro world and on how to choose the next micro world in the sequence.

Burton et al (1984) argue that micro worlds are created by manipulating three elements: the equipment used in executing the skill, the physical setting in which the skill is executed, the specifications for the given equipment and physical setting. They believe that these three manipulations allow the students to focus on the factors that are fundamental to learning a skill, rather than on factors that are not immediately relevant.

The different environments in rowing help to manipulate and support particular skills appropriate to the learners' abilities. The ergo, initially helps the learner to become familiar with the rowing position and the coach is able to demonstrate and hold on to the learner.

At this point, both the learner and the coach can talk to each other and ask questions without fear of falling off or getting wet. The ergo is designed for individual use, which means that the learner does not have to worry about 'timing' and other members of the crew. The ergo has an oar handle without the 'blade' which gives the learner greater control; the learner does not have to think about what the other end of the handle is doing. However, the tank is the first time that a 'blade' is used.

The situation is similar on the tank, where the learner is safe on the bank and his oars are limited in their movements. A restrictive wall is built in the water to prevent the oar from

going too deep and catching a 'crab'. The oars have holes in them, making it easier to 'drive' the oar through the water. The oars are slightly shorter, to allow more control, but this still does not give the learner the feeling of being on the water. The tank is stable and there is no fear of falling out into the water. These restrictions on the tank help and support the learners (the boys).

The next stage of development is the use of the 'tub'. The 'tub' is a wide rowing boat with various restrictions to assist the learner. The width of the boat gives the learner a feeling of safety, and the coach can still move up and down it to demonstrate any technical points. The oars are generally made of wood, with narrow 'spoons', so they can be 'drawn' through the water with ease. Once the crew feels confident, it will move on to the next stage, that is rowing in a 'best' boat. This will generally be an eight oared boat.

When the boys are in the 'eight', they are coached four at a time until they are good enough to row all eight. In addition to this coaching strategy, the blades are slightly shorter to allow greater control. These restrictions and modifications help to manipulate and support the development and progress of the learner.

The issue of the differences between the coaches is interesting because it highlights very different teaching styles and raises the question of where they come from and their beliefs about teaching and what they think is important. This then leads straight into study 4, which investigates Coaches beliefs.

One possible criticism of this study, is that it only looked at two coaches over three sessions in three learning environments. (However, that said, it did replicate the previous study.) One would need to carry out a much more extended study into coaching styles and techniques and to ensure that each session is identical for each of the coaches. Another criticism is that, this study did not take into account of the progress of the boys from one week to the next. The observations were not carried out at the same developmental stage for each coach. The rowing, ergos or the tank were not observed at the same period of the study. Week 1 may have been a tank session for Nick, followed by

a row with Tony, with week 2 observing the ergos only with Nick. The coaches used the learning environments in different stages of the boys' development of rowing therefore the differences could be due to their developmental stage. This study had to submit to the availability of the boys and coaches. Another problem with the study is that, each rowing session was totally dependent on the river conditions. Tony may feel that the boys still need to work on their hand positions at the 'finish' of the stroke, thus keeping them on the tank a little longer. Nick on the other hand, may feel that the boys need to concentrate on their 'timing', thus taking them out on the river more often. This raises the question about when the coaches employ these different environments. The two coaches had different views on coaching, and emphasised different elements of the stroke, but the water conditions had the greatest say.

Choppy water would mean that the coach would makes generalised comments only to all the boys, without being specific, thus not allowing any free time. So the environment would dictate the type and number interventions. Scaffolding in such conditions would be very difficult and not the desired objective of the session.

This chapter found that contingent tutoring was a very small proportion of the coaches' interventions. This study also found that learning environments influenced the nature of instructional interventions. It is clear that the coaches vary their approach to coaching. This is important because the coaches' views need to be considered.

Chapter 6 reports an interview study, which further investigates coaches' use of scaffolding and how this changes according to the different learning environments. This study indicated that scaffolding and contingent tutoring varied between the coaches and that it played a small part in their coaching/teaching. It is important to understand the coaches' accounts of their strategies and to broaden the study to the functions of scaffolding.

Chapter 6: Functions of Scaffolding in different learning Environments

6.1 Introduction

Chapter 5 was an observational study and found that coaches employed contingent coaching for only a small proportion of the time and that their coaching strategies are dependent on the environment. This study is an interview study of coaching rowing, which investigates the functions of scaffolding and they change according to the environment.

The study has three main aims. The first aim is to further examine coaching strategies. It investigates different types of coaching employed. The study will investigate whether the coaches employ any of the functions of scaffolding. Wood, Bruner & Ross (1975) shows that there are six functions of scaffolding.

i) Recruitment – Getting the students interest
ii) Reduction in the degrees of freedom – This involves simplifying the task
iii) Direction maintenance – Keeping them in pursuit of a particular objective
iv) Marking critical features – marking certain features of the task that are relevant
v) Frustration control – Making the activity less stressful
vi) Demonstration and Modelling – Modelling solutions of a task. Providing idealisation of the act.

Scaffolding is form of helping process, which can be differentiated from mere immediate assistance in that it involves both adult and child/learner interacting towards the solution of the task, rather than mainly the adult completing the task and explaining it to the child or the child passively observing the adult and extracting relevant information spontaneously. Scaffolding indicates the contingent nature of the assistance which seems to be required in order to lead to independent capacities on the part of the child or learner.

The study will also investigate whether the coaches employ the contingency rule Wood (1986). This rule states argues that contingent instruction is likely to act according to 'two rules' of teaching. The first rule dictates that any failure by the child to carry out an action after a given level of control, should be met by an immediate increase in help or control. Secondly, what happened when the child succeeds? This implies that less help will be given to the child to allow more freedom of success. The important criteria here, is how the teacher responds to the child's momentary success or failure judged after the given instruction. Thus, each time the teacher acts in accordance with the rules, they are considered to have made a contingent response.

The second aim is to examine whether the coaching strategy of the coach is dependent on the learning environment. The physical nature of the environment is an important factor in coaching rowing. The rowing tank, ergo and the various boats on the river make the instructions dependent on the type of activity taking place.

As mentioned in chapter 5, the coach can get close up to the learner and physically hold on to them while they are given instructions on the ergo and the tank. Thus demonstration becomes an important element in the coaching strategy. The learner feels safe and stable without fear of getting wet or falling out and being swept down river. This of course becomes the main fear when the boys eventually go out on the river. The coach cannot get up close to the individual boys; s/he thus relies more on generalised comments., and having to shout over the sound of the engine. It is expected that these different environments will influence the coaching strategies employed.

The third aim is to compare coaching strategies by looking at how teachers coach rowing compared to how the coaches coach rowing. In chapter 5 (observational study) there were differences between the coaches in terms of the amount of time they spent on each activity. One tended to focus on individual coaching on the tank, while the other focused on making general comments on the river in boats. There were also differences in the use of observation and scaffolding.

One observed more, which linked to the amount of free time he allowed and the other 'allowed' more questions to be asked. The use of scaffolding was minimal from both coaches. The teachers are employed by the Schools to teach a subject and to coach rowing as a games option. It does not necessarily mean that they have to be experts in coaching rowing, but someone who can drive the children down to the river. However, in this study, the teachers are themselves accomplished rowers, with some experience in coaching novices. The coaches on the other hand are employed by the Schools to help out with the large number of children. These coaches are usually known to the School, or otherwise based at the club as a 'professional'.

They spend their entire working time coaching school children of various abilities and adults of good ability; usually of national or international standard, thus being exposed to more varied abilities. It is often the case that the coaches have more experience of coaching beginners. It is expected that there will be some differences in the strategies employed by the teachers' and the coaches.

6.2 Method

6.2.1 Participants

i) Coaches

There are five coaches who are permanently based at the club or School boathouse. Their average age is 37.8, and range from 29 years to 62 years. Three are male and two are female. With the exception of Foxie (age 62) the other coaches are still actively rowing themselves. One of them is a current world champion and hopes to get an Olympic gold medal. Two coaches have coached to international level and are still involved with top British crews.

ii) Teachers

There are five teachers employed by the schools as subject teachers, with the ability to coach rowing as well. All the teachers are from independent school within the Surrey area.

One of the teachers has Blue from Cambridge University, another from Oxford and one with a 'Purple' from University of London. There are four female teachers and one male, with an average age of 31.6 years. There ages range from 23 years to 38 years,

6.2.2 Procedure

The interviews lasted between 30 and 45 minutes, and took place at the coaches' boat house, usually after the outing. The interviews were not tape recorded, but hand written whilst the conversation took place. All the participants felt happy with this arrangement and the fact that someone was showing interest in their activity.

6.2.3 Interview Questions

There are twenty-five questions structured in three ways. Firstly, are the general background questions (1-8). Second type of questions relate to the coaching strategies (9-21,24 & 25) and the third type of question, relates to the coaching environment (22 & 23).

i) General Background

1.Age
2. Sex
3.How long have you been coaching?
4.Are you a teacher that coaches rowing, or a rowing coach?
5.What is your coaching experience?
6.What is your rowing experience?
7.What is your teaching experience?
8.Have you any teaching qualifications?

ii) Coaching Strategies

9.What strategies do you use when you are coaching novices?

10.Do you mostly provide group instruction or individual instruction?

11.For example, when coaching novices in a four, do you have all four of them rowing straight away? Do you have them in pairs first?

12.What strategies do you employ when coaching a competent crew?

13. When do you give general verbal comments/encouragement?

14. When do you give specific verbal comments and encouragement?

15. When do you use demonstrations on the ergo, tank and on the water?

16. When do you give your crews free time during the session?

17. When do you/learner ask questions?

18. For example, how do you get them to clear the water at the finish?

19. Why do you use these particular strategies?

20. Where did you learn to coach rowing? Where you taught at School or a club, just observed others, or read up on the subject?

What difficulties do students have with rowing

24. At what point do you group according to ability?

25. How do you teach a particular point? What do you do if a learner does not understand a particular coaching point?

iii) Environment

22. Do you use the ergo and tank as well as the various boat types?

23. At what stage of your coaching do you use the ergo and the tank?

6.3 Results

For the full interview notes, see appendix A.

6.3.1 Background Questions

The number of years coaching ranged from 1 year to 14 years, averaging 7.1 years. One coach said that as a coxswain, he had been coaching for 40 years. Coaching shifts between young children of 14 years of age and competent adult crews. Some of the coaches have only coached at junior level, while others have coached at international level. Most the coaches have rowed themselves to a high standard, either at school or at a club. Two coaches have Blues (Oxford and Cambridge), while one has a (University of London) 'Purple'. Two coaches have won medals at World Rowing Championships and three have won medals at the National Championships.

The teachers and coaches work in Surrey and the teachers in particular are employed in independent schools that row. The coaches also work for the local clubs.

All the teachers have a degree with a PGCE. The coaches do not have formal teaching qualifications; they do not believe this to be important when coaching. One coach has a Bronze Coaching Award.

6.3.2 Functions of scaffolding

The responses from the interviews are analysed in terms of the functions of scaffolding. The functions of scaffolding include the following strategies.

i) Recruitment

A function of scaffolding used by the coaches used was recruitment. This was evidenced by a number of coaches reported they try to keep it fun and relaxed. Coach 9 explicitly states the need to keep it fun.

> *"Not to shout at them, because it is always tempting, since they are embarking on a relatively dangerous activity. Understanding and patience."* (Coach 7)

> *"Keep it fun essentially"* (Coach 9).

ii) Reduction in the degrees of freedom

One common method of reducing the degrees of freedom in rowing is to have the boat sat by half the crew while the other half rowed. All coaches (10 of 10) agreed that this was the best way to introduce a novice to rowing. This way Coach 7 states, those rowing felt secure, knowing that their 'blade' was doing the correct thing and that they were not going to fall out.

> *"I definitely use pairs first. Others provide stability, which makes it easier for the two rowing to feel relaxed and confident."* (Coach 7)

All the coaches felt that this strategy helped the individuals to gain confidence with the 'blade' in their hands. Coach 3 states that this method is used to help the students regain their balance and keep it stable.

> *"I will always make novice crews row or scull in crew boats and have half the crew at a time for five minutes each. This is so they can regain their balance with the boat being kept stable."* (Coach 3)

iii) Direction maintenance

Direction maintenance is keeping crew in pursuit of a particular objective, and if the crew do not understand anything, the coach tries other things. Some coaches try many things to keep the crew focussed on the task at hand in order to progress to the next stage.

> *'I use demonstration and then allow the individual to break down the components of any point. Secondly, I ask regularly after discussion, if every point is understood. Then ask them to carry out the instruction to see if my explanation is clear. This continually allows the coach to analyse his/her ability to communicate ability.' (coach 8)*

'If they don't understand a point, I find an exercise for them to do, or try a second example or explanation. I then come back to it rather than frustrate them if it becomes too much of a problem. I then get someone to demonstrate the point for them. If all fails, I then get another coach to have a look at them, and generally seek advice.' (coach 9)

"To clear the water at the finish, I get them to practice 'square' blades, with good hand/wrist position and feeling the boat as it passes under them." (Coach 1).

iv) Marking critical features

One function is to mark out critical features. The coaches carry out this function in a number of ways. Coach 4 below picks out individual points of technique. One coach picks out specific points to concentrate on in a particular outing.

"With competent crews, I make sure there is discipline within the boat. I get the crew to focus on the activity they are engaged in at the time. I pick out individual points of technique to concentrate on for the outing" (Coach 4).

Coach 2 used video analysis to mark out critical features.

"Self evaluation via video analysis and timed pieces, and ask them for their contributions." (Coach 2)

Coach 5 used structured exercises to mark out critical features. He used specific exercises to focus technical points.

"With more competent crews, I try to focus on a specific technical point for the whole crew. For example, an outing focusing on the catch speed with specific technical exercises." (Coach 5)

v) Frustration control

This aspect of scaffolding was not mentioned by any of the coaches.

vi) Demonstration and Modelling

Another function of scaffolding evidenced in coaching rowing was the use of demonstration. A number of coaches demonstrated the basic stroke on the tank and the ergo and get the boys to work through the technique themselves. Coach 7 below discusses how he uses videos of technically fast crews to demonstrate points

"I use videos, of the crew themselves and of very good technically fast crews." (Coach 7)

Coach 4 in the quote below used demonstrations at the beginning or end of sessions to illustrate key points.

'I demonstrate on the ergo mostly, trying to show how power can be used in a controlled way. This I do before the outing.' (Coach 4)

'I use the ergo for technical demonstrations quite often, especially after an outing to demonstrate something that a crew found difficult on the water.'(Coach 5)

Other coaches demonstrated aspects of the stroke out on the water with a spare paddle or their hand as the 'spoon' of the blade. This function of scaffolding was common practice amongst the coaches.

"I will normally give them a demonstration first anyway, and let them practice." (Coach 2)

6.3.3 Contingent Instruction

There was also evidence that the coaches were obeying the contingency rule. This rule states that contingent instruction is likely to act according to 'two rules' of teaching. The coach either increases the level explanation in response to a failure or decreases the level of explanation in response to success. Below a coach describes how he tries a number of alternative explanations before demonstrating it.

> *"Usually verbally or visually, or demonstrate it, or get someone else to. When they don't understand anything, I try to explain it again"* (Coach 2)

Coach 2 goes onto say how he uses various techniques, when one does not work he tries another. This technique is very similar to contingent tutoring.

> *"When they don't understand anything, I try to explain it again, usually verbally or visually, or demonstrate it, or get someone else to. I get them to practise it for themselves and repeat over again. If that doesn't work, I explain by using another method- video, ergo, white board, tank or tub."* (Coach 2)

A number of other coaches also made similar comments. Below coach 3 discusses how he uses the ergo to show the boys what he wants them to do.

> *'I will usually teach a particular point by going alongside the crew/individual I am coaching and stopping them explaining what I am trying to achieve. If they do not understand this I will use the ergo to show/explain what I am trying to achieve and I will also try to explain the particular point in various ways.' (coach 3)*

Coach 4 talks about how he breaks down the points into more simpler components to help the boys understand what he is trying to get at.

'I first talk through a particular point. Demonstrate by outlining particular points to work on, showing them what is expected and why they need to do a particular way. I always explain the benefits of doing things. If they don't understand a particular point, I bring them back in and break down the points into simple units to practice on.' (coach 4)

Coach 6 also shows how he changes his strategy dependent on how well the boys have understood something. When they do not undertstand, he uses the ergo to demonstrates. This quote clearly shows how the coach uses more and more explicit instructions ina manner consistent with contingent tutoring.

'I tend to teach all the crew together in the boat, going through exercises, explaining further what needs to be done and how to do it. If the technical point is difficult to understand, I take them to one side and explain again on the ergo or the tank, demonstrating all the time. I continue this until they understand. I try to establish what they can relate to, to see a picture in their mind, to get them to feel how things move and the different approaches they can adopt to achieve this. I then leave the individual to practice this on their own or with somebody else before they come back to the next session. I get them to demonstrate to me and then to the whole crew' (coach 6).

6.3.4 Group versus Individual Instruction

Interestingly, coaches us a mixture of group versus individual instruction. Coach 3 below talks about how he makes general comments to the whole crew and individual comments to individuals.

"All comments will be general to the whole crew and I try not to make specific comments to any particular individual unless there is a definite need to intervene, which would only be to stop an individual injuring him/herself by using very poor technique." (Coach 3)

The majority of coaches (8 of 10) used group instruction when coaching their novices in the early stages of the coaching period, because of the limited number of coaches available to coach and the limited time spent on the water. Coach 2 talks about how group instruction is used because of a lack of coaches

> *"I tend to coach as a group. Regrettably, my squad is too big and the coaching diluted. Not enough coaches generally, prevent me from coaching individuals."* (Coach 2)

> *"Rowing in an eight, I would make general comments, but on the ergo, I would use more specific comments. The environment is crucial to my type of instruction."* (Coach 8)

> *"I tend to provide individual instruction when I'm on the ergo and tank with the crew. Otherwise, I make generalised comments to a rowing crew, so they all benefit"* (Coach 10).

Specific instructions are also used to provide one-to-one coaching. Coach 3 & 7 talks about how one-to-one coaching is used to improve technique.

> *"Specific comments make up the bulk of all my instructions. Most of the people I coach are above novice level and are therefor able to begin to action any changes the in technique that I request. I approach rowing with the view that, it is a highly technical sport and therefor a large proportion of my coaching time is devoted to improving technique. This requires a lot of 'one to one' coaching of individuals weather they are in single sculls or in crew boats"* (Coach 3)

"I make specific verbal instructions and encouragement when I need a particular point done by individuals. This is when I expect an immediate response and feedback from the person. I then get the individual to repeat the instruction" (Coach 7).

6.3.5 Other forms of Contingent instruction

In scaffolding, interventions are made based on the success or failure of the student. The coaches in this study mention a number of factors that influence the crews when they coached. Comments are not just contingent on success and failure, the coaches talk about other forms of contingency.

i) Fatigue

One of these is the physical state of the student, that is how fatigued they. Coach 3 talks about how individuals ability to absorb information is dependent on how fatigued they are.

> *"General comments for experienced oarsman are given at towards the end of hard training sessions or throughout high intensity training sessions. This is done because the ability of individuals to absorb and respond to comments specific to an individual decreases with fatigue. General comments for the whole crew have grater impact on tired athletes as they generally are more basic instructions (i.e. hold the finishes out) and therefore shorter. Athletes when tired cannot always hear, understand or respond to long commands."* (Coach 3)

Similarly coach 4 talks about how concentration is difficult when the crew is tired.

> *"I try to motivate the crew before the outing. I look to ease the work- load to encourage technique, usually regarding power and posture, the catch and draw to the finish. It's very difficult to concentrate on good technique when the crew is tired."* (Coach 4)

Coach 5 talks about the difficulties of physical fatigue

> *"There are many difficulties they have with rowing. Firstly, there is the physical, tiredness, aches and pains and injuries."* (Coach 5)

ii) Time of session

The time of the session is also important. This will influence the nature and the structure of the instructions given..

> *"Most importantly, is to encourage them after an outing, and before a race."(*Coach 2)

Coach 8 talks about making comments when they are stationary.

> *"I tend to encourage them and make comments when they are stationary. This way we can discuss the various problems."* (Coach 8)

Coach 4 talks about making comments at the end of training piece, when the crew has stopped and when they are recovering.

> *"I usually make specific comments at the end of a piece, when the crew has stopped and they're recovering. I pick out good points of the row. However, there are times when I need to make specific comments during the row, so the individual can focus on a particular point."*(Coach 4).

A similar point is made by coach.6 below.

> *"I use specific instructions when practising particular technical points, or at the end of a timed piece."* (Coach 6).

iii) Environment

Another important factor is the environment. Demonstration is dependent in part on the environment. They all demonstrated on the ergo, tank and on the river. The ergo and tank allows the coaches to get 'hands on', which they feels is essential to get the sitting posture right. Coach 3 talks about using the ergo as a means of getting the point across when students are having difficulty with particular aspects...

> *"Demonstrations are often used when coaching from the bank (usually every outing). I will ask the people I am coaching to paddle near to where I am and give graphic instructions and make the individuals being coached replicate the point I am trying to make when they are stationary.*
> *I will generally follow up this point during the rest of the outing reiterating the points made from the earlier stationary demonstration. If I feel that the individual is having still trouble understanding the point I was trying to make, I will finish the outing and ask them to sit on the ergo and by both sitting next to them on another ergo and also physically putting them into the position I want them to be in whilst they are on the ergo I hope to get across the point I am trying to make."* (Coach 3)

Some coaches (3 of 10) said that they would always use the ergo or the tank if the river was too fast or dangerous to go out. Coach 1 talks about using the tank when its particularly rough

> *"It's (the Tank) useful because we can use it anytime, especially when it's rough on the river."* (Coach 1).

Coach 9 talks about using different types of instructions dependent on the environment. A similar point is made by coach 9.

"Instructions are given as and when they are required. General instructions on the tank and individual encouragement on the ergo or on the water." (Coach 9)

"I find it easier to make individual comments on the ergo or the tank." (Coach 10)

iv) River Conditions

Another factor is the river conditions. When the river is flowing too fast or is dangerous, the coach has to decide what to next. The options open to the coach is to take the crew on the 'ergometer' or work on the tank. Coach 1 makes this point clear.

'Again, I get can get 'hands on' and position them anytime. This is a good tool to improve rowing. It's useful because we can use it anytime, especially when it's rough on the river.' (coach 1)

'Yes always, especially when I have a difficult point to make, and when the conditions are bad.' (coach 1)

6.3.6 Comparing teachers and Coaches

The first difference between the coaches and the teachers' is that they have different backgrounds. The teachers had all been to independent schools and learnt their rowing and coaching while they were at school.

The teachers (5 of 10) learnt to row at school. Their coaching experience began by observing and using their own experience.

"I learnt to coach at school and rowing at the club. I observed others as well as reading up on it." (Coach 10)

"I learnt to row at Bedford modern School and Star Club. I've done many ARA courses and have read many books. I've read Redgrave, Topolski, Maygothling Cross, Nolte, Weare, Chuter, MacElroy,Mahon, Grobler and Spracklen" (Coach 2)

The coaches (5 of 10) learnt to coach at their respective clubs, by using their experience and observing others.

"I observed others. My father was a rowing coach, so I had little chance of doing anything else. I then did the ARA instructors award." (Coach 6)

The coaches generally group according to ability after four to six weeks, and depending on the availability of coaches.

"I group as early as possible, usually within six weeks. This makes it easier for the coaches to coach, and simpler for the crews to develop at the same rate." (Coach 2)

That said, one coach did not group according to ability, but grouped according to desire to win, motivation and commitment. He felt that the individuals would eventually reach a level of competency, and that those willing to succeed will win.

"I group people not on ability only when they reach a fairly advanced stage/level of rowing. With juniors & people lower down the rowing categories I usually group relative to their competitive ability not their technical ability. I would rather have four technically fairly rough and keen/competitive people than four technically good but not keen or competitive people. People who enjoy racing will usually always beat people who don't." (Coach 3)

They spend their working lives as coaches at the various centres in Surrey. They are totally dependent on the schools to send their children to learn to row.

"I learnt to coach at Molesey Boat club, by observing others, reading about it from experts. Coxing makes it easier for me to understand and coach, since I can feel the difference instructions can make." (Coach 5)

Secondly, teachers and coaches approach the boys in a different ways. The coaches treat the boys as club members and not as school boys. They are less concerned about exams, homework, and social life in general. As one coach put it,

"I put a great deal of emphasis on a structured training programme to develop optimum fitness and concentration on the finer details of individual and crew technique, and then have it disrupted by exams and holidays abroad with parents." (Coach 10)

Despite these few differences between the coaches and the teachers, there are more similarities between them. They all start coaching on the tank and ergo, running through the basic technique with the boys, and they all try to build up the boys' confidence by stabilising the boat while they are rowing. They all complain about the lack of time and coaches to be effective. They all agree that demonstration is very important and that the river conditions dictate how the session will run. Free time was seen as luxury, because none of them could afford the time. Overall, there are more similarities than differences. Ultimately, both teachers and coaches are concerned about developing a crew that will race in the summer.

The Amateur Rowing Association has a number of coaching awards. These begin with the Instructors' Award, where progression is made to the Bronze award, then the Silver and finally the Gold, to the most experienced coach. Each course is run over a week, and the coaches need to start with the instructors' award before they can take the next course.

6.4 Discussion

This chapter was an interview study of the coaches' accounts. The first aim was to examine their coaching strategies. From the interviews they showed evidence that they used the functions of scaffolding.

First, was the interesting function for recruitment; to make the sessions, fun and relaxing. (question 9). The second function was the reduction in the degrees of freedom. They do this in many ways, by using different boats and different environments. Also by getting the half the crew to row and half the crew to stabilise the boat, and by reducing the boys' 'blade depth' on the tank by a wall in the water. This stops their oar from going to deep, thus giving them more control in the handle. (question 11). Thirdly, was frustration control. The coaches go over things if the students are having difficulty understanding a particular point. The coaches would explain the problem another way, either demonstrating or using video-tapes to help. Others would ask for help from a more experienced coach. (question 25).
The fourth function was marking critical features by using exercises and pointing to key aspects of their technique. (question 18). The fifth function was the use of demonstration and modelling. This was apparent in many of their answers. (question 15)

There is also evidence of contingency used by the coaches. The coaches responses showed evidence that they adjust their interventions depending on the success and failure of the crew. Responses to questions 13, 14 and 25 showed some evidence that coaches were scaffolding. However the coaches' interventions are not entirely based on the success or failure of the crew. They are based on a number of other factors. Firstly, was time in the session. Verbal encouragement was usually given when the crew was either getting boated, when they were stationary or at the end of the session. (questions 10, 12, 13, 14 & 16). Secondly, was the state of the rower. That is, many of the boys suffer from fatigue and exam pressure. This of course had a detrimental effect on their ability to concentrate on technique and to work at the correct level. (question 13, 14, 21 & 25).

Thirdly, was the environment. The nature of the environment allows the coach to get close to the individual to make specific comments and to demonstrate a particular point of technique. The tank and ergo allowed the coach to get very close to the boy and instruct him without affecting what goes on around them. While he was being coached, the other boys could continue with their ergo or tank without interruptions. (question 13 14 & 25). The weather conditions were another important aspect. This was particularly a problem for crews during the winter months, when it was cold, the river was flowing fast and the wind was blowing hard. (questions 21, 22 & 23).

All but one of the coaches grouped according to ability. Grouping according to ability, allows the crews to progress at the same rate, thus contributing to reasonable outings in the boat. In this way, those crews that are faster than others' can continue to progress and develop without being held back. However, one coach, grouped according to drive and motivation. He saw this as developing the competitive nature of the boys and the crews, in to a competitive environment. (question 24).

The second aim of this chapter was to look at the different learning environments e.g. ergo, tank and river. There were differences in learning environments and the amount of time spent on each activity. Like chapter 5, much of the coaching took place on the river, with the conditions dictating the nature of the outing. Twice as much specific individual coaching took place on the river, than any other environment, whilst the number of coaching interventions remained similar. This is expected, since rowing is largely based on the river.

Demonstration took place largely on the bank, either on the ergo or the tank. The tank being the most used training environment. The coaches can get up close and give individual instruction as well as making more generalised comments. S/he can hold the boy and correct his sitting or hand position. Observation is an important part of rowing, hence the amount of time spent on the river. Observations last much longer, when the crews are out on the river. The coach can study technique without saying anything to the crew, until they have finished the outing. Scaffolding as such played a small part in

coaching rowing, but its functions were clearly used. The differences in the environment provided differences in terms of coaching and the number of interventions.

The third and final aim of the study was to compare coaching strategies. The teachers,' were employed by the School as classroom teachers. They taught a main subject as their priority and took a games session on one or two afternoons a week. The extra coaching took place in their own time, in the evenings and at weekends. The nature of rowing requires that a great deal of time was spent going over technical points and training. It thus becomes very time consuming. Since rowing was only a games option, their priority lies elsewhere. However, it was not to say that they do not concentrate on developing a crew; especially for Henley Royal Regatta, which was very prestigious for rowing Schools.

The coaches on the other hand are not classroom teachers, but employed to coach at the boathouse. They are either employed on an hourly basis or on a permanent contract. Their job would be to develop a racing crew for the summer. They are essentially professional coaches who tend to be rowing themselves, and they have the experience to coach at a good level. It is in their interest to create a fast crew. They treat the boys in a different way to the teachers. The boys are seen as potential internationals and not as little schoolboys. The less formal environment helps this situation.

One possible criticism of this study is that it looked at ten coaches over one session. (However, that said, it did replicate the previous study.) One would need to carry out a much more extended study into coaching styles and techniques and to ensure that each session is identical for each of the coaches. One would need to carry out more interviews at the end of the season to see the real differences. This study interviewed coaches at the beginning of the season, when the boys are complete novices. One would need to look at how the boys had developed by the end of the summer, after a year of racing.

The interviews were not carried out at the same developmental stage for each coach. The coaches used the learning environments in different stages of the boys' development of

rowing, therefore the differences could be due to their developmental stage. This study had to submit to the availability of the coaches.

Another problem with the study, was that, each interview session was dependent the previous outing. The responses of the interviews were often influenced by previous outings. A good outing may have produced a different response than a bad outing earlier in the day. One coach may have felt that the boys still needed to work on their hand positions at the 'finish' of the stroke, thus keeping them on the tank a little longer. Another coach, on the other hand, may have felt that the boys need to concentrate on their 'timing', thus taking them out on the river more often. This raises the question about when the coaches employ these different environments.

The ten coaches had different views on coaching, and emphasised different elements of the stroke, but the water conditions had the greatest say. The previous outing had a profound effect on the session.

Choppy water would mean that the coach would makes generalised comments only to all the boys, without being specific, thus not allowing any free time. So the environment would dictate the type and number interventions. Scaffolding in such conditions would be very difficult and not the desired objective of the session.

Chapter 7: Discussion and Conclusion

Chapter 7 discusses these findings in terms of their theoretical and practical implications, but first here is a brief summary of the thesis.

7.1 Summary of the thesis

The aim of this thesis was to investigate the effect of scaffolding on the acquisition of rowing among 13-14 year old boys. Chapter 2 reviewed the theoretical underpinnings of scaffolding and then reviewed the various studies investigating the effects of scaffolding on children's learning. This research has still tended to focus on formal subjects, employing young children and the tutors are either parents or experimenters who provide individualised instruction or small group instruction. In fact, Hobsbaum et al., (1996) argued that scaffolding only takes place on an individual basis. The aim of this thesis was to investigate the effects of scaffolding in a more informal setting (i.e. learning to row); with larger groups (i.e. a rowing eight). It also involves children who are older than the children that have generally been studied in studies of scaffolding.

Chapter 3 reported an initial investigation into the role of contingent tutoring in learning to row. It looked at twelve 13-14 year old boys over five sessions, with a pre-test at the beginning and a post-test at the end of the coaching sessions. These two sessions were video-taped and analysed to measure the effectiveness of contingent tutoring, with specific attention paid to the rowing stroke cycle. The study found that contingent tutoring was a useful teaching strategy, and that the contingency of the coaching instruction was a good predictor of how well the boys' learnt to row.

Chapter 4 replicated and extended the study reported in chapter 3. However, unlike the previous study, this one investigated contingent tutoring in three different learning environments; the 'ergometer' 'rowing tank' and the boat out on the river, which were naturalistic and informal contexts. This study looked at sixteen boys and three coaches, and it found that the coaches employed contingent tutoring and were sensitive to the

needs of the boys. It showed that the coach used less explicit instructions, as the boys made progress.

Another interesting finding, was that the different learning environments, differed in terms of the amount of contingent tutoring and the level within the region of sensitivity. Unlike the previous study, this study found a negative and significant relationship between the proportion of contingent tutoring and the level of ability of the boys. Another study was required to investigate the use of different coaching techniques.

Chapter 5 was an observational study of coaching rowing. It looked at sixteen boys aged 13-14 and two coaches, one who was a classroom teacher, while the other was a specific rowing coach. The boys were seen individually as well as collectively in groups, and the sessions were video-taped. Most of the coaching activity was used to make generalised instructions, with little scaffolding going on. Group based instructions made up 26% of the interventions, while individual instructions made up 33% of the coaching. The coach spent the rest of the time observing. As expected, specific instructions were made to individual boys. The classroom teacher made more general encouragement, while the rowing coach tended to make specific instructions. Most of the specific instructions were given on the river, compared to the land based activities of the rowing tank and the ergometer.

Interestingly, this study also found, that contingent tutoring was a small part of coaching, only 8% and that the coaches employed different teaching strategies to different learning environments. This small percentage of contingent tutoring could explain the differences between the two studies. Contingent tutoring is only a small part of coaching students to row. In study 1, which was much smaller and more focussed on one environment, it was positively related to learning. However, in study 2 which was larger and involved three learning environments, it had much less of an influence. The coaches were using other strategies, which were having a greater influence on students learning to row. Therefore, it was necessary to conduct a further study to investigate these different strategies coaches used.

Chapter 6 was an interview study, examining coaches and their use of different strategies in different learning environments. Five coaches were interviewed at their own training venues, for approximately forty minutes. There was evidence that the coaches used the functions of scaffolding; that is making the sessions fun and relaxing, reducing the degrees of freedom, marking critical features to work on, and to demonstrate and model the rowing stroke. There was also evidence of the coaches being contingent. They demonstrated how they would adjust their interventions, based on the success and failure of their instructions. They also adjusted their instructions according to the different environments: the time in the session and the physical state of the students.. Chapter 6 found that the functions of scaffolding were widely used during the normal coaching session. Overall, scaffolding was an important and useful tool during everyday rowing and coaching.

7.2 Theoretical Implications

7.2.1 Contingent Tutoring

The first two studies examined contingent tutoring. The first study found that the proportion of contingent tutoring was comparable to Wood's (1975) findings and that contingency was related to learning to row. The second study hoped to replicate the first, and to investigate the relationship between contingency tutoring and learning to row. However, this study examined contingent tutoring in three different learning environments, one on the water, outside and two on land, inside and it found no significant relationship between the amount of tutoring and learning to row. A possible reason for this inconsistency was found in study 3 reported in chapter 4 which found that only a tiny amount of coaching interventions were contingent.

One of the main findings of this study was that contingent tutoring was not always related to learning to row and that it was only a small part of rowing. This contradicts the findings of Wood and Middleton (1978). Wood in his studies conducted research with

parents in a one-to-one tutoring situation. In this study the coaching was conducted in groups.

Thus, possible reason for discrepancy between the findings reported in this thesis and the findings reported in the work of Wood and others were that the coaching was conducted in groups rather than in a one-to-one basis. Wood himself commented on how difficult contingent tutoring is and that it can only be done on an individual on-to-one basis. It was necessary to widen the study of scaffolding and look at their functions. This was required, because scaffolding alone could not explain the progress of the boys' and their coaches' strategies.

7.2.2 Functions of Scaffolding

However what was interesting about this study was that it found that the functions of scaffolding were used by the coaches. The functions of scaffolding are as follows.

1. Recruitment

For recruitment, the coaches made the sessions fun, enjoyable and relaxing. Competitions were often used to focus attention and concentration to the tasks in hand.

2. Reduction in the degrees of freedom

When reducing the degrees of freedom, the coach used half the crew to row the boat, while the other half sat still and balanced the boat. The coach would also simplify the task on the rowing tank, by using oars that were shorter than normal or with holes in them. Having a concrete beam in the water, also eased the rowing stroke, by keeping the oar from going too deep and catching a 'crab'.

3. Frustration control

Frustration control, another function of scaffolding, was widely used, especially when the crew or the individual did not understand a particular point. The coach would explain the problem again, or get another coach to explain the point in a different way, or the crew would simply watch a video of the correct technique.

4. Marking critical features

For marking critical features, the coach would introduce various exercises to improve technique. 'Back stop' rowing is always a popular one, to help 'draw' the 'finish' of the stroke to the body, with full power and clean extraction of the blade. Other technical exercises include rowing half strokes to help speed up the 'catch'.

5. Demonstrations and Modelling

Demonstration and modelling, is another important function of scaffolding, and widely used by the coaches. Coaches either produced videos of the correct technique, for all to watch or got a member of the crew to go through the correct cycle on the rowing tank or the ergometer. The coaches always gave the boys certain objectives to achieve during each session, which differed to each other, based on the experiences of the previous outing.

Thus, theoretically one of the most interesting observations of the thesis was finding that contingent tutoring was rare and did not seem to be important in learning to row. That said the coaches did seem to use the functions of scaffolding quite widely. This lead, to examining their own accounts of their teaching strategies.

7.2.3 The Importance of the Different Environments

An interesting finding was the importance of different environments in leaning to row. Three different environments were used in learning to row in this thesis: ergometer, tank and racing boat.

Theoretically this is interesting because Wood in his theory of scaffolding does not have much to say about how the environment can be used to scaffold learning. One of the characteristics of scaffolding is the reduction of the degrees of freedom or simplifying the task. However Wood and colleagues did not discuss how the environment could be altered to reduce the degrees of freedom.

One of the more detailed discussion of how the environment could be altered to scaffold learning was by Burton, Brown and Fischer (1984). They discussed how the learning environment is modified for people to learn to ski.. They analysed the features of a highly successful learning environment in order to articulate a general theory of learning environments. They argue that learning environments, could be examined in terms of a paradigm called 'increasing complex micro-worlds' (ICM). Micro-worlds are created by manipulating three elements

i) the equipment used in creating the skill
ii) the physical setting in which the skill is executed
iii) the specifications for the given equipment and physical setting.

They believed that these manipulations allowed the students to focus on the factors that were fundamental to learning a skill.

i). The equipment

Burton, Brown and Fischer (1984) argue that, the equipment given a student is changed to create different micro-worlds. Their example of this in skiing is varying the length of

the ski. In the 'graduated length method' a beginner is started on short skis, as the learner becomes proficient, his skis are gradually lengthened to full-length skis.

Short skis are used as transitional objects in the learning process and make skiing easier to get started to create early successes. They argue that short skis allow the student to focus on and learn fundamental elements of skiing before going on to difficult tasks.

The ergometer is set up in a position to allow the novice to get used to the action of rowing. As the learner becomes more competent, the setting is re-adjusted to cater for this improvement. Similarly, the rowing tank is made simple in the beginning, by using shorter oars or ones with holes in them. As the learner improves, longer oars are introduced. The boat is set up to allow the learner to make early successes.
Oars are generally shorter to allow greater control in the water. All these adjustments are transitional, which makes it easier to get started and make early success more likely.

The equipment used, the ergometer, rowing tank and the rowing boat, all differ, and they assist the learner in different ways. The ergometer and the rowing tank, are land based activities, used inside at any time. The rowing boat is used outside on the river at any time, except when the conditions are extreme; flowing too fast, or too windy. The ergometer is land based, and it initially helps the learner to become familiar with the rowing position. It is designed for individual use, so there is no pressure to follow others and keep in 'time'.

There is an oar handle without the shaft to worry about and more importantly, it is stable and firmly place on the ground. The rowing tank, another land based activity, is the first time the learner uses an oar. The situation is similar to the ergo, in that, it has a stable platform to work from, but differs, because, they now have to follow the 'stroke' and keep in 'time' with others. The rowing boat varies in size, from a single scull, one person with two blades, to an eight oared boat with a coxswain. The stability has now reduced considerably, and the river conditions are constantly changing and each crew member is responsible for their own rowing as well as the stability of the whole crew.

ii) The physical setting

The physical setting is another method for creating micro-worlds. Burton, Brown and Fischer (1984) argue that skiing is an integrated collection of sub-skills. A major aid in learning any complex collection of skills is the opportunity to practice the sub-skills independently.

Micro-worlds must be found or designed to allow the learner to exercise particular skills. For the novice skier, gliding and stopping are essential sub-skills that have to be learned. But stopping cannot be practised without gliding, and gliding is dangerous unless one knows how to stop.

The authors argued that, the problem could be solved by choosing the right setting. By the choice of a downhill slope that feeds into an uphill slope, the sub-skill of stopping is avoided. Modern ski areas provide another manipulation of the environment that simplifies the skill of skiing. They provide the novice with constant snow conditions. A beginner can learn to manoeuvre on packed slopes without having to worry about the varying depths of the snow.

The ergometer and the rowing tank are land-based activities, which removes the balance problems of the rowing boat. The ergometer has an oar handle without the shaft, to create the action of rowing. This allows the learner to concentrate on the rowing action without worrying about a three meter oar. The rowing tank has concrete beam in the water to prevent the oar from going too deep and the blades have holes in them to reduce the workload in order to sweep through the water.

The oar can also be manipulated, by reducing its length, giving more control to the user. There is also a large mirror on the wall, so the learner can look at their rowing position and make adjustments as they become more competent rowers. Both these activities are land based, which means that the learner does not have to worry about balance or falling

into the river. As the learner becomes proficient, the added skill of learning to balance the boat is introduced.

The boat is less stable, and dependent on the natural elements; wind, temperature and the flow of water. The crew can be given various exercises to help with technique; one half of the crew rowing, while the other half balances the boat. In this way, the boat becomes more stable and gives the learner more confidence to row without the fear of falling into the water. Sometimes, the crew would change between sculling (two oars) and rowing with one blade.

These three environments, allow the learner to develop and progress, irrespective of the river conditions, whether a crew member is missing, or whether there is a lack of time to complete a session. The manipulation of the learning environments, is an ongoing and changing process.

iii) The physical setting and the equipment

It is thus possible to alter the environment by changing the task specifications. The learner may be asked to perform different tasks with the same equipment in the same setting. For example, a skier may be instructed either to traverse down a slope or to follow the fall line, the steepest way down, (depending on what sub-skills are being perfected). The manipulation of task specification is also used to teach higher level skills. When a skier is presented with a gentle slope, he may be instructed to view turning simply as a means of going where he wants to go. Later, when presented with a steeper hill, he may be instructed to view turning as a means of controlling his speed. The authors argue that task specification is a way to focus the learners' attention on the important factors in the micro-world.

In rowing the learner may be instructed to 'drive' harder during the stroke. He may be on the tank alone, but when others join him, he may be instructed to keep in time and work

at the same level. In this way, he has to focus his attention to the task at hand, otherwise, he will be out of time and disrupt the crew.

The ergometer, can be adjusted according to size, strength and fitness levels. The level of pressure is adjustable, and the dials show time, rate of stroke and distance rowed. All these features allow the learner to progress and measure performance. Initially, the learner may be instructed to 'warm up' on the machine to get used to it. Once this process is over, s/he will be required to perform particular tasks. The learner may be instructed to row half slide, with emphasis placed on the 'catch'. Once this episode is over, the learner may be instructed to row full slide, at full pressure to measure performance.

The rowing tank, is also adjustable. The 'foot board' can be moved to accommodate tall or short people and the length of oar can be changed according to size and power.

The 'gearing' on the oar, can be adjusted to create more or less resistance and a solid 'spoon' can be used as well as one with holes in. These adjustments are designed to assist the learner as they make progress and give them more autonomy in what they do. As the learner becomes more competent, s/he is more able to control their training and coaching, thus enabling them to work in their own time away from the group.

The rowing boat is dependent on the level of competence of the learner, in addition to size, strength and fitness levels. The 'gearing' can be adjusted, the 'height of work' on the 'rigger' can be changed and the feet position can be altered to accommodate height. In essence, the rowing position can be tailored to suit the individual within the crew. Each position can be personalised to each individual.

The micro-world can provide the right entry point into an environment, making it easier to get started on a sub-skill. It must also make the learner feel safe, allowing him to focus his attention on learning skills. Its goals and challenges must be attainable, with sub-skills taught in isolation, to avoid confusion.

7.2.4 Different Types of Contingency

This thesis also has implications for the types of contingency. Wood (1975,1978, 1986, 1996) outlines three ways instruction can be contingent: instructional contingency, domain contingency and temporal contingency. Study 4 reported in chapter 6, identified a three other types of contingency.

i). The time of session

This type contingency was evident throughout the coaching sessions, where the coaches altered their instructions depending on the time of the session. The time of the session was important to the development of the crew. The coach usually instructed the crew while it was resting or turning around.

ii) Physical state of the crew

The physical state of the learners' has to be taken into account by the coach. An individual too tired, will certainly perform below the coach's expectations; concentration will also be below what is required to achieve the aims of the session.

iii) Learning environment

The equipment used at the time, will be dependent on what the coach wants to achieve from the session and also the conditions of the river. Rough water, will make it difficult to go out in a boat, so the coach may decide to get the crew on the ergometer.

7.3 Practical Implications

This thesis has a number of practical implications

7.3.1. Contingency

The finding that the effect of contingency on learning to row was inconsistent and also rare has important practical implications. Thus, this thesis does not provides unequivocal support for the idea that coaches should use contingent tutoring to coach rowing. As already mention part of the reason for the inconsistent finding could be that it is very difficult to provide contingent tutoring in a group situation. Possibly if the coaching was on an individual basis contingent tutoring may be effective, but research needs to be carried out to confirm this idea.

7.3.2 Functions of Scaffolding

Another finding that has important implication was the observation that the functions of scaffolding are used widely in coaching rowing.. Wood, Bruner and Ross (1975) introduced six functions of scaffolding, all of which were used in learning to row.

All these functions are particularly important in learning to row and all the coaches in this study used them to assist the novice. The other interesting point is that the function of scaffolding can and were been provided in a group situation.

7.3.3. Environments

The use of different environments in learning to row was also an important finding in this thesis and has a number of important practical implications. Initially, it depends on whether the learners' are new to the activity. The novice rower was introduced to the ergometer and/or the rowing tank to get used to the activity.

'I always use the ergo and the tank, especially for novices and testing more competent people. It is technically helpful.' (coach 7)

The river conditions also determine the nature of activities and instructions.

'I use the tank a lot in the winter, because of the river conditions.' (coach 5)

Testing fitness levels are better carried out inside, but it depends on what the coach is trying to achieve.

'I use the ergo for fitness and technique twice a week.' (coach 5)

Different environments require different approaches to coaching. Land based activities are primarily used for testing and demonstrating, which extended to the boat during the normal session.

7.3.4 Time of Session, Physical State & River conditions

Another important finding was that coaches took into account the time during the session, the physical state of the student and the river conditions. These findings have important practical implications. The timing of the instructional intervention is very important for the coach. S/he has to take into account the mental and physical condition of the individuals and the crew as a whole. If the crew is tired or fatigued from the previous session, then the coach has to make a decision on the next course of action.

The river conditions also play an important factor to the level and content of instructional interventions. That said, there is difficulty attached to the level of contingency of individual students within a group. The coach has to be aware of different requirements of the students, in different settings and with the practical difficulties of coaching individuals within a group.

7.4 Methodological Implications

The diversity of method, strategy and tactics were important and a successful aspect of this thesis.. Chapters 3 and 4 used naturalistic studies to investigate the effect of contingent tutoring on learning to row. These studies provided equivocal support for the benefits of contingent tutoring and revealed the importance of different environments to learning to row. Chapter 5 was an observational study. This study began to show the range of coaching interventions that were used in a group situation and gave an overall impression rather than focusing on one aspect coaching (for example contingent tutoring).

Chapter 6, looked was an interview study. It interviewed 10 experienced coaches to talk about the reasons behind the methods they used to coach rowing. These interviews began to reveal insights into the thought processes of the coaches and revealed how they used coaching strategies, which closely resembled the functions of scaffolding. Without the use of these different methods it would have been difficult to come up with as full a picture as this thesis reported.

7.5 further work

The problem with this study is that, although there is evidence to suggest that coaches use the functions of scaffolding, there is little evidence to say that it is actually beneficial. Chapters 3 and 4 looked at contingent tutoring and investigated whether there was a relationship between contingent tutoring and learning to row. One method of investigating the functions of scaffolding would be to look at these functions in a similar way that this study investigated contingent tutoring. For example experimental approach could be used to compare one coach using the functions of scaffolding during the coaching sessions and another coach using non-scaffolding techniques. One would expect that, those coaches using the functions of scaffolding, would see greater success than those coaches using other methods.

This thesis also found that the environment was so important for the type and amount of

instructional intervention. Futrure studies could compare a group or individual on an ergometer (land based activity) with a similar group or individual on the water. Again, the type of instruction, the amount of scaffolding could be analysed to compare environments.

Another possible study, would be to compare a group of boys against individuals in similar environments. The expected outcome, would be that contingency tutoring would be greater with individuals than with groups. This can further be extended, by comparing different environments, with groups and individual.

Coaches have different approaches to coaching in different environments. Another further study could examine a coach using the same approach in different environments. Instructions have to remain constant, irrespective of environment in this way the coach's bias would be reduced, which would give a clearer understanding of the environmental impact on instruction.

7.6 Conclusion

The aim of this thesis was to investigate the effect of scaffolding on the acquisition of rowing among 13-14 year old boys. The thesis found inconsistent evidence for the effectiveness of contingent tutoring in learning to row and found that it did not occur a great deal in the coaching session. The thesis did find that different learning environments were used in coaching rowing and that these were used to scaffold the learning process. Coaches were also found to use the functions of scaffolding. Therefore scaffolding is important in coaching rowing. The important outcome is that, something other than scaffolding is taking place. Scaffolding is not and ideal metaphor to capture the nature of coaching rowing, perhaps 'group contingency' would be more appropriate.

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Appendix A: Interviews with Coaches

C	Q	Answer
0	**1**	**Age**
1	1	Age 33
2	1	23
3	1	Thirty Five
4	1	38 years old
5	1	31
6	1	29
7	1	29 years old
8	1	62
9	1	33
10	1	I am 34 years old.
0	**2**	**Sex**
1	2	Female
2	2	Male
3	2	Male
4	2	Female
5	2	Female
6	2	Female
7	2	female
8	2	Male
9	2	Female
10	2	Male
0	**3**	**How long have you been coaching?**
1	3	Coaching 5 years
2	3	I have been coaching for 5 years
3	3	On and off for five years.
4	3	Currently since September 2001
5	3	I have four years coaching experience
6	3	I've been coaching for 9 years
7	3	I have coached on and off for the last 8 years.
8	3	I've been coaching for 6 years, but as a coxswain, I've been coaching for 40 years.
9	3	I've been coaching for 14 years on and off.
10	3	I've been coaching for 10 years.
0	**4**	**Are you a teacher that coaches rowing, or a rowing coach?**
1	4	Teacher that coaches
2	4	I am whatever is going best at the time. (A rower usually)
3	4	A rowing coach.
4	4	I am both teacher and rowing coach. I suppose I'm a teacher that coaches.

5	4	I am a teacher that coaches
6	4	I'm a rowing coach
7	4	I am a rower who coaches.
8	4	I am essentially a rowing coach, and not a teacher as such.
9	4	I am a teacher that coaches.
10	4	I am a rowing coach.
0	**5**	**What is your coaching experience?**
1	5	Coaching School children J15-J18 and at U23 women. LWT 1X international
2	5	Bronze award coaching certificate, university and School. I have coached many crews to National level, with many winning medals.
3	5	Have coached part time14-16 year olds at Beckett School in Nottingham for two years, also coached a single sculler to silver a National Championships at Walton rowing club. At present I coach at St George's College in Weybridge and responsible for Fifth and Sixth form male pupils.
4	5	I have previously coached at LEH. Lady Eleanor Holles School in Hampton, for about a year.
5	5	I started rowing at the age of 15
6	5	I've coached novice crews, women's senior 2 fours, in sculling and sweep oar.
7	5	My coaching experience is a bit limited.
8	5	I coach juniors from 10 years to 18 years.
9	5	I've coached at Oxford, I've coached women's veteran crews and junior school crews.
10	5	I've coach at Walton Rowing Club. I've coached juniors on the whole, and some senior three's.
0	**6**	**What is your rowing experience**
1	6	Rowed since 1990, UL Purple and Cambridge Blue.
2	6	My rowing experience is not so impressive-senior 2. I have been rowing since 1992, I am also a National medal winner.
3	6	I started rowing and sculling at the age of seven at Walton rowing club and competed first as a coxswain and then progressed through the junior levels of sculling competition until I reached eighteen when I started competing at senior level in rowing and sculling. I competed successfully for Walton rowing club progressing through all the domestic categories of rowing and sculling reaching elite standard by the age twenty-two. I moved to Nottingham In 1990 to train with NCRA where the national lightweight team coach was based and also many world medallists and world finalists. As an oarsman there, I represented Great Britain and England at World and Commonwealth Championships. In 1992 I won a world silver medal in Lightweight eights and broke the world record during that year. I also have reached several world finals in various boat classes since 1992 . In 1994 I won the commonwealth regatta in

		Lightweight Eights. Have also won many medals in international regattas around the world.
4	6	I am an elite oarswoman. I've rowed as a light weight in a 4- and Women's Henley winner, with two silver medals at the National Championships.
5	6	I am now a member of Molesey Boat Club
6	6	I've rowed for 15 years at junior national level and senior national level, in both sculling and rowing.
7	6	I've rowed for 15 years at national and international level. I became world Champion this year in Switzerland. (W2-)
8	6	I've been a coxswain for many years. I sculled and rowed for 46 years.
9	6	I've rowed for 15 years. I have three Oxford Blues and seven national championship gold medals. I have also been a member of the women's lightweight squad.
10	6	22 years rowing experience, reaching elite status.
0	**7**	**What is your teaching experience**
1	7	Sixth year teaching 11-18, boys and girls.
2	7	I'm an NQT
3	7	I have no teaching experience, as I am not a teacher.
4	7	I have taught at St. Teresa's School for two years, one year as supply teaching and currently with Kingston Grammar School.
5	7	I've been teaching for four years, three years at Surbiton high School and one year at Kingston Grammar School
6	7	I don't have any teaching qualifications, but that doesn't matter when coaching crews.
7	7	I have spent one and a half years as a teacher's assistant.
8	7	I don't have any teaching experience in the classroom, but I suppose what I do now is effectively teaching, just not in the formal sense.
9	7	I have taught for 10 years.
10	7	None in the formal sense.
0	**8**	**Have you any teaching qualifications**
1	8	PGCE
2	8	PGCE
3	8	I have no formal teaching or coaching qualifications.
4	8	I did a PGCE in Geography and combined sciences.
5	8	I have a PGCE
6	8	I don't have any rowing qualifications either. It's not important.
7	8	I don't have any teaching qualifications.
8	8	I don't really have any formal teaching qualifications.
9	8	PGCE
10	8	I don't have any teaching qualifications.
0	**9**	**What strategies do you use when you are coaching novices?**
1	9	Strategies for coaching novices-first outing in a tub, going through the use of terms (jargon), and the choice of boat depends on the

		number of children, age and conditions of the water. The aim is to build confidence in handling a blade (oar), building drills, checking timing and stopping. General boatman skills. Then a capsize drill and swimming test prior to this.
2	9	I aim to keep my coaching simple. I explain what I want before we go on the water, either have a quick session on the ergo, tank or tub, or maybe watch a video.
3	9	When coaching novices I try to keep a relaxed feel to the session and give large gaps between making comments on technique. All comments will be general to the whole crew and I try not to make specific comments to any particular individual unless there is a definite need to intervene, which would only be to stop an individual injuring him/herself by using very poor technique.
4	9	When coaching novices, I begin with a demonstration. I have pupils in boats on the bank and then in boats to feel the balance. I start in small boats, sculling or in pairs in a bigger boat.
5	9	When coaching novices, I introduce them to the boathouse first, with all its equipment, and then I introduce them to basic technique on the ergo; with a video as well. I then go through the safety drill with them- that is a 100m swim in full kit and a capsize drill. On the water , I teach them what to do if they fall in. They need to stay with the boat in a safe position. Then I gradually introduce them to the skills of rowing. I begin with fixed seat and square blades, gradually introducing the slide with feathering blades when they are ready for it. I then talk to them about turning and manoeuvring exercises.
6	9	The first thing when coaching novices, is not to shout. Secondly, to be clear with instructions and to avoid jargon and terminology. Thirdly, to explain the basics on an ergo, introduce the boat, then begin to use terminology. Demonstration on the ergo is very important at this point. I try to get the coxswain to become the coach, so the crew can effectively look after themselves when they progress.
7	9	Not to shout at them, because it is always tempting, since they are embarking on a relatively dangerous activity. Understanding and patience.
8	9	Understanding and practise. Both about equal I would say.
9	9	Keep it fun essentially.
10	9	I place a lot of emphasis on teaching technique and generating enthusiasm.
0	**10**	**Do you mostly provide group instruction or individual instruction**
1	10	Generally provide group instruction, due to the limited number of coaches with lots of children, otherwise, I would spend more time on individuals.
2	10	I tend to coach as a group. Regrettably, my squad is too big and the coaching diluted. Not enough coaches generally, prevent me from

		coaching individuals.
3	10	This depends on which group I am taking and how large it is.
4	10	I provide group instruction on the whole, but concentrate on individuals for specific points.
5	10	I tend to provide group instruction on the land, ergo and tank and more individual instructions on the water.
6	10	I mostly provide group instructions to fours or pairs.
7	10	I tend to provide group instruction when on the water and individual instruction when on the ergos. I use both methods on the tank.
8	10	I use both on the whole, but it depends on who I'm coaching and what activity there're doing. Rowing in an eight, I would make general comments, but on the ergo, I would use more specific comments. The environment is crucial to my type of instruction.
9	10	I provide group instruction on the whole, because all novices would benefit from it.
10	10	I tend to provide individual instruction when I'm on the ergo and tank with the crew. Otherwise, I make generalised comments to a rowing crew, so they all benefit.
0	**11**	**For example, when coaching novices in a four, do you have all four of them rowing straight away? Do you have them in pairs first?**
1	11	When out in a four, I get them to row in pairs first of all, because there is a stable platform to work off. This gives the kids a feeling of stability, and allows them go through the rowing stroke without worrying about the balance. The boat is moving slowly, which makes it easier to coach individual faults.
2	11	I always start by coaching in pairs. I start with 'square' blades and half slide, so they can get familiar with the rowing stroke. It helps, because the rest of the crew can keep the boat stable.
3	11	I will always make novice crews row or scull in crew boats (except pairs) and have the crew row/scull of half the crew at a time for five minutes (approximately) each. This is so they can regain their balance with the boat being kept stable.
4	11	With beginners, I start in singles and pairs (in a four) with the other two balancing the boat so the two rowing can feel safe and comfortable while they get used to being in boat.
5	11	In a coxed four or a quad, I would begin rowing in pairs, while the other two sit and balance the boat for them. I then offer specific technical points to individuals.
6	11	When I'm out with an eight, I get four rowing first, while the others balance the boat for them. eventually getting the whole crew together.
7	11	I definitely use pairs first. Others provide stability, which makes it easier for the two rowing to feel relaxed and confident.
8	11	I have half the crew rowing, while the other half balances the boat.

		They would do single strokes or two at a time.
9	11	When coaching a four or an eight, I only have half the crew rowing at a time. This allows stability for the two rowing.
10	11	I tend to start with half the crew rowing, and gradually introducing the whole crew to the stroke. Rowing in pairs usually.
0	**12**	**What strategies do you employ when coaching a competent crew**
1	12	With competent crews, I tend to look for one major fault of the crew and try to coach out of it. For example, in a 4X (quad scull) I get them 'swinging' back, following through, with quick elbows, matching the speed of the leg drive, with the hands moving away at the same speed as they came in.
2	12	Self evaluation via video analysis and timed pieces, and ask them for their contributions. We tend to have good group discussions.
3	12	The overall strategy of coaching experienced crews is the same as inexperienced crews but the motivation and watermanship of more experienced athletes allows different psychology and technical exercises to be used. The aim is to get the whole crew rowing the same way and giving them the achievable goal of all rowing the same way and developing crew unity. The crew rowing 'as one' has obvious speed advantages but making individuals feel part of a group or unit gives individuals the comfort that they can trust and rely on their crew mates to help them if they are having a bad race. This allows the crew to be greater than the sum of its individual parts as the crew members can push themselves further than they would have if they were on their own because there are always other people in the crew to help out if an individual over extends him/herself.
4	12	With competent crews, I make sure there is discipline within the boat. I get the crew to focus on the activity they are engaged in at the time. I pick out individual points of technique to concentrate on for the outing.
5	12	With more competent crews, I try to focus on a specific technical point for the whole crew. For example, an outing focusing on the catch speed with specific technical exercises. I also offer individuals technical points to iron out individual problems, and get the crew rowing better together, for example one crew member needs to sit up at the finish or lead with the left hand.
6	12	I tend to coach from a launch, cycle along the bank or scull along side them. I video the crew, do timed pieces with them and spend plenty of time checking their technique.
7	12	With more competent crews, I use visualisation techniques. The idea of imagery and seeing yourself in a different context and trying to imagine how it feels to do a particular stroke. I use videos, of the crew themselves and of very good technically fast crews.
8	12	With competent crews, I would observe them closely and make

		comments, general and specific, if I think it helps. When there're racing, I would always make general instructional points.
9	12	I always start with a warm up, and I use exercises to stress the point I'm trying to make. I try to get the crew to think about their rowing all the time.
10	12	I put a great deal of emphasis on a structured training programme to develop optimum fitness and concentration on the finer details of individual and crew technique.
0	**13**	**When do you give general verbal comments/encouragement?**
1	13	13. I have 'verbal diarrhoea' – I keep reinforcing the same point over again for them to work on., and tell them when they get it right. I try and encourage them all the time.
2	13	When needed really. When improvement is shown, I always compliment them and encourage them to go further. Most importantly, is to encourage them after an outing, and before a race.
3	13	General verbal comments /encouragement are given to novice crews throughout the training cession, or towards the end of hard training cessions for experienced oarsman. Novice oarsman generally do not have the watermanship skills needed to make precise changes to their technique. Therefor the use of general comments for such people brings the crew together more quickly. General comments for experienced oarsman are given at towards the end of hard training sessions or throughout high intensity training sessions. This is done because the ability of individuals to absorb and respond to comments specific to an individual decreases with fatigue. General comments for the whole crew have grater impact on tired athletes as they generally are more basic instructions (i.e. hold the finishes out) and therefor shorter. Athletes when tired cannot always hear, understand or respond to long commands.
4	13	I try to motivate the crew before the outing. I look to ease the work load to encourage technique, usually regarding power and posture, the catch and draw to the finish. It's very difficult to concentrate on good technique when the crew is tired.
5	13	I use general verbal comments to the whole crew; the whole crew change in technique, would affect boat speed.
6	13	I give verbal encouragement all the time, especially to novices. All oarsman need encouragement during the session.
7	13	I tend to make general instructions when the boat is moving well on the water, when the crew are working well together.
8	13	I tend to encourage them and make comments when they are stationary. This way we can discuss the various problems.
9	13	Instructions are given as and when they are required. General instructions on the tank and individual encouragement on the ergo or on the water.
10	13	When there is a general problem that needs addressing or general encouragement is required.

0	**14**	**When do you give specific verbal comments and encouragement**
1	14	I always praise them when they get something right. Reminding them that they are tired and about maintaining their posture.
2	14	On technical coaching points on the water.
3	14	Specific comments make up the bulk of all my instructions. Most of the people I coach are above novice level and are therefor able to begin to action any changes the in technique that I request. I approach rowing with the view that, it is a highly technical sport and therefor a large proportion of my coaching time is devoted to improving technique. This requires a lot of `one to one' coaching of individuals weather they are in single sculls or in crew boats. I give encouragement to the people I coach as much as possible due to the competitive nature of the training schedules that are set. When athletes try to respond to coaching, weather they achieve the task in hand or not, they should be encouraged for their effort As long as they keep trying they will improve (if the coaching advice that is given is correct).
4	14	I usually make specific comments at the end of a piece, when the crew has stopped and they're recovering. I pick out good points of the row. However, there are times when I need to make specific comments during the row, so the individual can focus on a particular point.
5	14	I make specific comments to individuals to encourage them.
6	14	I use specific instructions when practising particular technical points, or at the end of a timed piece.
7	14	I make specific verbal instructions and encouragement when I need a particular point done by individuals. This is when I expect an immediate response and feedback from the person. I then get the individual to repeat the instruction.
8	14	This depends on the type of activity. Ergo would demand specific instruction, while the boat will tend to require more general instruction. It's far too simplistic to say this and stick to it.
9	14	Specific instructions are given when the crew is stationary or when we're on the ergos.
10	14	when there is a specific individual or crew matter that needs addressing or there is a specific need for encouragement. I find it easier to make individual comments on the ergo or the tank.
0	**15**	When do you use demonstrations on the ergo, tank and on the water?
1	15	Ergos first for novices. It allows hands on, where I can physically hold them hand position them correctly. I also use the ergo for general coaching, and testing. It is especially handy to access to the ergo, because quite often the conditions are too dangerous to go out, so we use these. I use the tank just as much with competent crews as well as novices. They have a huge mirror , so they can see themselves rowing and change their technique as appropriate.

		Again, I get can get 'hands on' and position them anytime. This is a good tool to improve rowing. It's useful because we can use it anytime, especially when it's rough on the river.
2	15	I always demonstrate on the ergo and water. Tanks would be good, but access is a problem.
3	15	Demonstrations are often used when coaching from the bank (usually every outing). I will ask the people I am coaching to paddle near to where I am and give graphic instructions and make the individuals being coached replicate the point I am trying to make when they are stationary. I will generally follow up this point during the rest of the outing reiterating the points made from the earlier stationary demonstration. If I feel that the individual is having still trouble understanding the point I was trying to make, I will finish the outing and ask them to sit on the ergo and by both sitting next to them on another ergo and also physically putting them into the position I want them to be in whilst they are on the ergo I hope to get across the point I am trying to make.
4	15	I demonstrate on the ergo mostly, trying to show how power can be used in a controlled way. This I do before the outing.
5	15	I use the ergo for technical demonstrations quite often, especially after an outing to demonstrate something that a crew found difficult on the water. I use the tank for three sessions to teach scullers or sweep oars. This is especially useful because they don't have to worry about the river conditions or the balance of the boat or the steering. I often use my hand or a paddle to demonstrate when we're out of the water.
6	15	I use the ergo to demonstrate at the start of the session for novices, to explain particular points. I always carry a blade around with me, exactly to do this.
7	15	I use demonstrations as often as I can. I believe that if the oarsmen can see what is expected of them, they will respond better and learn quicker.
8	15	As soon as possible, after seeing poor technique.
9	15	I demonstrate on all the apparatus, ergo, tank and on the water. Demonstrations are given all the time, especially in the first few weeks.
10	15	When there is a particular problem that needs to be addressed, a demonstration of specific technical points to individuals or crews would benefit all. I use a boy to demonstrate on the ergo or on the tank, and I use a blade to go through the motions, either on the bank or the tank. I sometimes feel the need to demonstrate myself on the tank.
0	**16**	**When do you give your crews free time during the session?**
1	16	I don't really give them free time as such, but I do let them paddle without me saying anything to them. This allows them a chance to think about their rowing without me shouting at them. I tend to send

		the slowest off first, quickest last, others get overtaken, so they get coached.
2	16	Hopefully never. Perhaps when crews are going well, I'll leave them alone for a while.
3	16	If I am out with crews I will generally pick one point of technique per outing. I will peruse this point all outing which means giving instruction/demonstration and then giving the crew a while to adjust to the change in technique. However, I will not let them just get on with their outing without persisting to encourage the change I want. I do believe however that people should have about sixty percent free time, so I will let have several outings a week without any instruction or at least very minimal comments. People become irritated by someone telling them to do something they are already trying to do. Often people will progress much quicker by their own trial and error on a particular point once they understand the nature of the change they are trying to make.
4	16	I don't usually give free time, because of limited number of coaches and time of the session.
5	16	The use of free time is difficult. During land sessions, we have short breaks in between circuits and weights, when we can have a drink or change our clothes. On the water, tops come off before a piece or to have a drink when we have stopped to turn around. On Saturday mornings, we have a 45 minute break between outings.
6	16	Free time is usually given to the crew after their warm up or before they wind down. The other time is during their second outing at the weekends.
7	16	I tend not to give free time because it is rather limited. I need to get as much from the outing or the session as possible.
8	16	I don't really, we don't have enough coaches or time to let them go off on their own.
9	16	I tend not to. We rarely have time and we have a limited number of coaches.
10	16	Never, if it can be avoided. I don't usually have the time to do this, or the extra coaches to help out.
0	**17**	**When do you/learner ask questions?**
1	17	Questions are asked when we are stationary, we discuss points before the outing anyway as well as after the outing. But during the outing, this takes place once we have stopped for a rest or to turn around. We discuss general points, timing, etc. I might ask how it feels, or how it's going. I always give them a summery at the end- what we have achieved, and what we set out to do next outing.
2	17	When I want feedback, when I want to know how to improve my coaching and their technique. Questions are very important for all of us.
3	17	I usually ask for feed back from the crew to find out weather the changes I request have made the individual or the crew feel more

		comfortable. Often different individuals require the same technical point explaining in different ways to understand it. Every person is different and I try to explain the same point to people in different ways I they do not.
4	17	There are questions before the outing, always, during the outing when we have stopped to turn around or before doing a piece. Then there is time at the end to discuss the session.
5	17	I tend to ask questions usually after a session, or after a specific exercise to ascertain if the learner can feel a difference. I do try to encourage questions from the crews, either in breaks in the session or at the end.
6	17	Questions are asked at any, only when we have stopped though. Also before and after the outing.
7	17	I ask questions at the start, during and the end of the session. The crew ask questions during those times as well as the time spent on the water-usually when we have stopped. I do not encourage talking during rowing at all.
8	17	At the time if possible or soon after that.
9	17	Questions are asked by all of us, especially when we are beginning to start a piece, or turning around.
10	17	I'm constantly asking questions, they are to, especially when we have stopped. No questions while we are rowing along.
0	**18**	**For example, how do you get them to clear the water at the finish?**
1	18	To clear the water at the finish, I get them to practice 'square' blades, with good hand/wrist position and feeling the boat as it passes under them. I often have an old blade in the boat with me, so I can demonstrate the point clearly. I keep reminding them of their hands.
2	18	When coaching this particular point, I ask them to tap down with the palm of their outside hand. (approximately 2 inches). I will normally give them a demonstration first anyway, and let them practice.
3	18	Experience
4	18	To clear the finish, I get them to level their hands in sculling, to lead with the left hand. In a sweep oar, I get them to drew the finish high and to push down with the outside hand an to turn with the inside. Rather like an oval shape.
5	18	When clearing the water at the finish, I explain the concept with lots of square blade to encourage correct movements of hands. Single stroke to finish position, with blades feathered to encourage uniformity throughout the boat. I then give them a long paddle to consolidate what they have learnt. In between exercises, and paddling, I try to re-iterate the purpose of exercises and demonstrate the concept again if necessary.
6	18	I get the crew to circle their hands round the turn, or do plenty of

		single strokes with square blades.
7	18	I get the individuals to row or scull doing square blades, especially when they first start. Later, I get them to visualise the movements of rowing, imagining it's like that of a bicycle chain rotating round.
8	18	I use square blades and get them to circle their hands round the turn.
9	18	The first thing I do is get them to use hands only rowing and then to row with square blades. This gets them to rotate their hands around the turn.
10	18	By describing the necessary hand movements, demonstration, explaining how clearing the water at the finish is one part of a continuous movement that is the whole stroke. Practice through repetitive exercises.
0	**19**	**Why do you use these particular strategies?**
1	19	I use the these strategies, because I think they work, often an exercise like 'square' blades will cure a fault, without having to coach the fault constantly.
2	19	They have worked in the past and I am open to ideas. I not the sort of person who thinks that I am always right. We all have different ways of making a crew go well.
3	19	I learnt to coach rowing from my experiences as an oarsman and by observing how coaches coached others and myself.
4	19	I feel that this has always worked and it gives them a mental picture of what to achieve.
5	19	I use these strategies to promote a permanent positive change in technique. I keep re-iterating, demonstrating and consolidating the required technique to ensure that they understand what needs to be done to make the boat go faster, so they can enjoy the sense of speed and win races.
6	19	This technique allows them to see the importance and to understand why they need to be done.
7	19	These are the techniques I have found useful myself as a rower and sculler.
8	19	They are clear to understand, and it has always worked in the past.
9	19	This allows them to focus their attention to the task at hand.
10	19	The individual needs to understand what they need to do, not just accept it without understanding. With this understanding, they need to practice so they can actually do it for themselves.
0	**20**	**Where did you learn to coach rowing? Where you taught at School or a club, just observed others, or read up on the subject?**
1	20	I learnt these techniques from my own rowing experience. I reached a pretty high level in the sport, with lots of top coaches. I just put into practice the bits and pieces, I think are good.
2	20	I learnt to row at Bedford modern School and Star Club. I've done many ARA courses and have read many books. I've read Redgrave,

		Topolski, Maygothling Cross, Nolte, Weare, Chuter, MacElroy,Mahon, Grobler and Spracklen.
3	20	The biggest difficulty in coaching students is their attention span. To get students to concentrate for long periods of time is the most difficult thing. A lot of rowing training is made up of long laborious outings and making these interesting is a difficult task. Also managing their time effectively. Better organisation generally will help their rowing concentration.
4	20	I learnt to coach by being coached myself. I attended a technique day at my club a few years ago.
5	20	I learnt to coach at Molesey Boat Club for Surbiton High School. I also have an ARA Instructors award. I regularly spend time observing and listening to top coaches like Steve Gunn, Pete sheperd and John West. I also ask these coaches to listen and comment on my coaching.
6	20	I observed others. My father was a rowing coach, so I little chance of doing anything else. I then did the ARA instructors award.
7	20	Just by observing others.
8	20	I learnt to coach at Molesey Boat club, by observing others, reading about it from experts. Coxing makes it easier for me to understand and coach, since I can feel the difference instructions can make.
9	20	I learnt to coach from my own experience and by observing others.
10	20	I learnt at School and at the rowing club. I observed others as well as reading up on it.
0	**21**	**What difficulties do students have with rowing?**
1	21	The obvious difficulties, of confidence, worried about falling in, lack of spatial awareness, wrong place on the river/steering. The biggest problem is lack of time to commit to the sport.
2	21	Mainly listening and understanding technical points. Getting them to concentrate on a new exercise is very difficult. They are naturally anxious.
3	21	Yes and any other means I can to get across a particular point.
4	21	There are many problems that the children have. They have such busy lives, that getting themselves organised is difficult. But once rowing, they have difficulty in applying power to the stroke. With 14-15 year olds, they do not have the strength, or the ability to push themselves. All they want to do is rush up and down the slide, without much control. If they could slow down, take their time, they would be in a better position to apply their power.
5	21	There are many difficulties they have with rowing. Firstly, there is the physical, tiredness, aches and pains and injuries. Secondly is the time commitment, fitting in School work. Thirdly, there is motivation, children sometimes feel forced into the training, unlike club rowing where they have chosen to do it. I try to instil the idea that they do it for their own gains and not mine.
6	21	There are many difficulties. Terminology is often difficult to

		understand, and the need to work together as a crew makes individuals frustrated. Balance and timing is always difficult at the start.
7	21	The biggest problem is time, we don't have enough of it, and organising our lives. Once rowing, it is balance and co-ordination.
8	21	Time. They do not have time to spend on the river or on the ergo. Balance and confidence on the water is a problem.
9	21	There are many difficulties. Firstly, is getting the individuals to become fully committed. Secondly, there is the pressure of exams.
10	21	Training interrupted by holidays and exams.
0	**22**	**Do you use the ergo and tank as well as the various boat types?**
1	22	Yes always, especially when I have a difficult point to make, and when the conditions are bad.
2	22	Yes, whenever possible.
3	22	I use the ergo and tank once the people I am coaching have moderate balance and technique. To use such techniques on novices is difficult because they cannot usually grasp the point you are trying to make and novices usually just want to get out on the water.
4	22	I tend to use the ergo mostly, but the tank is always useful. Of course I use many types of boats. It gives them another perspective of the rowing stroke. Each boat type requires a different approach to it. Smaller boats require more power, and bigger boats require more speed with the hands and legs.
5	22	I use the ergo for fitness and technique twice a week.
6	22	I use the ergo and the tank all the time, especially the ergo. I can get so much explained in a short time, without getting the boat out. time is a limiting factor to my coaching.
7	22	I always use the ergo and the tank, especially for novices and testing for more competent people. It is technically helpful.
8	22	yes, I use the ergo all the time, and the use of various boats, pairs, singles, fours and eights.
9	22	I use all the available equipment. Ergos and the tank as well as the various boat types. All this depends on the number of individuals and the number of coaches available at the time of the session.
10	22	Yes, the use of ergos for fitness training and to demonstrate rowing technique.
0	**23**	**At what stage of your coaching do you use the ergo and the tank?**
1	23	With novices at the beginning of their rowing. With experienced crew, before the outing. For testing, or bad conditions. I usually give a quick demonstration first of what I expect from them.
2	23	I use the ergo throughout my coaching, but especially at the beginning.
3	23	
4	23	This varies. Early on, I look at how co-ordinated they are on the

		ergo. I'm not necessarily looking at the work they apply. I tend to focus on breaking down the stroke to get each part of the stroke following smoothly but separately.
5	23	I use the tank a lot in the winter, because of the river conditions, and the ergo afer the outings to demonstrate technique again.
6	23	The start of the session and throughout the season. All the time.
7	23	The ergo is helpful for all levels. It acts as a training and testing tool as well as a technical device.
8	23	I tend to use the ergo at the very start of the session. This is particularly important for novices.
9	23	I use the ergo and the tank at the beginning of the season, especially for fitness training and during the periods of Red Warnings on the river.
10	23	Throughout the year, but in conjunction with training in the boat and when the conditions are too bad to go out.
0	**24**	**At what point do you group according to ability?**
1	24	I group as soon as possible, but that depends on the number of coaches.
2	24	I group as early as possible, usually within six weeks. This makes it easier for the coaches to coach, and simpler for the crews to develop at the same rate.
3	24	I group people not on ability only when they reach a fairly advanced stage/level of rowing. With juniors & people lower down the rowing categories I usually group relative to their competitive ability not their technical ability. I would rather have four technically fairly rough and keen/competitive people than four technically good but not keen or competitive people. People who enjoy racing will usually always beat people who don't.
4	24	With my J15's, I kept them mixed for a month. Then on, I put them into specific crews for the Head of the River Race. With the girls, I took the top eight, and put them into two fours by size. With the boys, there are clearly four of them ahead of the others, and the rest I made an eight who are very interchangeable.
5	24	I spend the first couple of months of the season in mixed crews, then start grouping on the water after that.
6	24	I group when it becomes fairly obvious in the boat. Usually early on in the season.
7	24	I tend to group as soon as possible. Grouping according to ability, often helps the crew develop together.
8	24	I group as soon as possible, but it depends on the availability of boats and coaches.
9	24	I group according to ability when we have a sufficient number of coaches.
10	24	When crews are being selected to race.
0	**25**	**How do you teach a particular point? What do you do if a**

		learner does not understand a particular coaching point?
1	25	If they don't understand anything, I generally hold them, going through the motion with them. I get them on the tank or ergo and encourage them. I hold the handle and then physically hold them. I get them to use their leg drive first, or demonstrate myself, or watch a video of them or a top class oarsman with good technique.
2	25	When they don't understand anything, I try to explain it again, usually verbally or visually, or demonstrate it, or get someone else to. I get them to practise it for themselves and repeat over again. If that doesn't work, I explain by using another method- video, ergo, white board, tank or tub.
3	25	I will usually teach a particular point by going alongside the crew/individual I am coaching and stopping them explaining what I am trying to achieve. If they do not understand this I will use the ergo to show/explain what I am trying to achieve and I will also try to explain the particular point in various ways.
4	25	I first talk through a particular point. Demonstrate by outlining particular points to work on, showing them what is expected and why they need to do a particular way. I always explain the benefits of doing things. If they don't understand a particular point, I bring them back in and break down the points into simple units to practice on.
5	25	I teach by explaining how and why we do things, demonstrating, re-iterating and simplifying if they don't understand.
6	25	I tend to teach all the crew together in the boat, going through exercises, explaining further what needs to be done and how to do it. If the technical point is difficult to understand, I take them to one side and explain again on the ergo or the tank, demonstrating all the time. I continue this until they understand. I try to establish what they can relate to, to see a picture in their mind, to get them to feel how things move and the different approaches they can adopt to achieve this. I then leave the individual to practice this on their own or with somebody else before they come back to the next session. I get them to demonstrate to me and then to the whole crew.
7	25	I try different ways of wording the point if individuals find something difficult to understand. I will often use demonstration, and ask other coaches for advice, wording or new ideas. I will then try new exercises to practice.
8	25	I use demonstration and then allow the individual to break down the components of any point. Secondly, I ask regularly after discussion, if every point is understood. Then ask them to carry out the instruction to see if my explanation is clear. This continually allows the coach to analyse his/her ability to communicate ability.
9	25	If they don't understand a point, I find an exercise for them to do, or try a second example or explanation. I then come back to it rather than frustrate them if it becomes too much of a problem. I then get

		someone to demonstrate the point for them. If all fails, I then get another coach to have a look at them, and generally seek advice.
10	25	By verbal explanation, demonstration, video analysis of the learner, comparison with a crew or individual, (international crew) who are performing the particular point.

Appendix B: Analysis of Observations

3.3.1 Nick on Rowing Tank

	Nick Tank
Coach	Nick is an Old Boy of the School, and he came through the system and he desperately wants to be a professional coach. He is very keen, but he has limited experience. Nick gets all 16 boys to line up around the tank while he demonstrates the rowing action. He talks to them about the session and what they expect to achieve from it. He begins by showing them how to get into the boat, how to hold the handle, the position of the legs and the general postures whilst rowing. The boys listened carefully while all this was going on. He then sat the first 8 boys on the tank while the others stood by and watched. He began by making a few general comments, repeating the hand position on the blade, the legs at the finish. There was no scaffolding going on at this moment. Nick got the boys sitting in the start position with the blades 'square' in the water and then got them to row together. The boys are rowing on a stable platform, so there is no balance problem and the blade depth is controlled by a wall in the water. The blades have holes in them to allow the water to flow through, which makes it easier to 'draw' evenly, without oscillating. The boys began rowing one stroke at a time, with hands away and bodies over, then up the slide.
	Demonstration. Coach
Coach	He begins with the stroke man on stroke side, telling him that his blade is not 'square' in the water and that rest of the crew were following him, so he had to set a good rhythm.
	General . Individual
Boy 1	Are my feet meant to be flat on the foot-board?
	Question. Individual
Coach	Not when you're coming forward to take a stroke, your heels should lift slightly. That's better, well done.
	Specific. Scaffolding
Coach	Number 3, look at your blade, what is it doing? Is it vertical in the water? Is it going through water straight, or is it trying to go too deep?
	Specific. Individual
Boy 3	OK sir
Coach	Your 'spoon' is not quite vertical as it goes into the water, it's slightly 'under squared'. Can you see?
	Specific. Individual
Boy 3	Yes

Coach	OK, push your 'button' tight against the 'gate'. No! Look at your 'sleeve', that's better, well done, good
	Specific. Individual
Coach	Nick now holds on to 3 and goes through the stroke cycle with him again.
	Demonstration. Individual
Coach	Well done number 2, your timing is good.
	Specific. Individual
Coach	Nick checks that twos hands are positioned correctly on the handle
	Observation. Individual
Coach	Nick begins by checking bows hands and feet before doing anything else
	Observation. Individual
Coach	Are you OK bow?
	Specific. Individual
Boy 4	Yes sir.
Coach	You're rowing very well, you've had time to listen to what I've been saying and time to adjust your technique.
Boy 4	Am I rowing long enough?
	Question. Boy 4
Coach	Yes, your length is good and you're in time.
	Specific. Individual
Coach	Nick explains that the stroke man is responsible for the rhythm of the boat, and that everyone behind has to be given time to follow.
	Observation. Individual
Coach	Nick holds on to stroke, checking his hands are in the correct position.
	Demonstration. Individual
Coach	Move your 'outside' hand to the end of the handle. Well done. Does that feel better?
	Specific. Individual
Boy 5	Yes.
Coach	You have more control of the blade now and you can draw more effectively. OK, well done, you're rowing well now. Remember, they're following you.
	Specific. Scaffolding
Coach	That's good 3, well done. Your hands are well positioned and your length is good. Keep an eye on your blade every now and again, making sure that it's 'square' in the water.
	Specific. Individual
Coach	Nick stands by and looks on. Satisfied, he moves onto number 2, but has a glance at the whole crew. At this point, he makes a general comment, repeating what he said earlier about technique.
	Observation. Individual
Coach	OK 2, you're rowing well, but keep following stroke. You must stay in

	time. That's better, well done. In a boat, you'll actually feel the difference, and you'll know if you're out of time."
	Specific. Individual
Coach	Nick now moves to the back of the tank and looks at bow. He holds on to bows body, making sure the position is correct. At the same time he would be talking and commenting on posture and body position
	Demonstration. Individual
Coach	That's better, can you feel the blade going through the water? Think about what your legs are doing. Are you sure your rowing long enough and in time?
	General. Individual
Coach	However, Nick does not give bow a chance to answer any of these questions. He spends more time with bow, making sure that he is following stroke and that his blade is accurate in the water.
	Observing. Individual
Coach	Look at your blade, is it 'square in the water?
	Specific. Individual
Boy 9	Not quite.
Coach	Why?
	Specific. Individual
Boy 9	I don't know
Coach	Look ! your 'button' has moved away from your 'gate', see?
	Specific. Individual
Boy 9	Yes.
Coach	OK, push your blade right out. Now do you feel the difference
	Specific. Individual
Boy 9	Yes
Coach	Well done, that's better. Keep rowing long though.
	Specific. Scaffolding
Coach	Nick stands close by encouraging him further, and then moves to the front of the tank. At the front, he stops the crew for a rest. The boys are now a little tired, but have time to run through the rowing cycle once again. Then they all change over. Because the boys were on the ergos, Nick did not feel the need to run through the introductory explanation.
	Observation. Talking. All
Coach	Remember the basic technique, hands, 'squaring' up. Starting with your arms only, then full slide, get ready go.
	General. All
Coach	While they are rowing, Nick talks to them about reaching out and squaring their blades. He goes over to check up on a boy who is having a particular problem
	General. All
Coach	What's the problem?
	Specific. Individual

Boy 11	My feet keep coming out."
	Question. Boy 11
Coach	"Change your 'stretcher' setting and look at the straps. That's better
	Specific. Individual
Coach	He then gets the boys to think about these two points and makes sure that they are adjusted correctly
	General. All
Coach	Firstly, follow the speed of the blade through to the finish. The handle moves away from the body at the same speed as it comes in as. Secondly, you put the blade in the water before you drive with the legs.
	General. All
Coach	Make sure you drive right through to the body
	Specific. Individual
Coach	Nick holds on the handle and follows it through to the finish of the stroke. At this point, nick points to number 2 and gets him to think about squaring his blade earlier. He holds on to bows handle and follows through to the finish of the stroke with him, still talking about the correct hand positions
	Demonstration. Individual
Coach	At this point, he stops stroke side and gives them a rest and gets bow side to think about the rowing cycle again. Nick is always repeating the basic technique, hoping that it will become second nature to the boys.
	General. All
Coach	Square earlier and keep in time with stroke. Very good, well done. Same with you bow.
	Specific. Individual
Coach	Bow, hold your legs longer on the finish, allow your hands to move away over your knees before you bend them. That's it well done. Can you feel the difference?
	Specific. Individual
Boy 15	Yes.
Coach	You're getting a little sloppy now, that's primarily due to tiredness, buts that's now excuse for poor rowing.
	General. All
Coach	At this point, Nick moves to the front of the crew, missing out 2,3 and stoke, and gets them to stop. Both sides are now sitting and listening to him. Nick gets them to think again about their technique and re-starts them with stoke side first, and getting bow side to join in. He continues to make general comments and praising them when he can.
	General. All
Boy 9	Am I going too fast?
	Question. Boy 9

Coach	No, you're doing fine, but remember, that you have a crew behind who needs to keep in time with you.
	Specific. Individual
Coach	Nick continues to make general comments as the session ends. The second group were given more general comments, while the first group experienced more individual, hands on coaching. This could be due to the fact that, they had been in the tank for a long while and people were getting tired and frustrated. The interesting teaching point, is that all the boys responded immediately to the instructions given, and when a boy did not understand anything, he quickly asked for help and assistance.
	General. All

3.3.2 Tony Tank

Coach	The session with 16 boys took place on the rowing 'tank'. He had them chopping and changing during the session until all 16 had been on the tank. There was no particular time when this occurred, but it was done when there was a natural gap. The session lasted approximately 50', with Tony doing most of the talking and the boys listening. There was the occasional question, with one boy demonstrating the basic stroke
	General. All
Coach	He had them warm up for 8 minutes on the 'ergo' before getting them on the 'tank' and he began by talking to them in general terms about the basic structure of the rowing stroke. He mentioned the hand positions on the blade, keeping the legs flat at the 'finish' of the stroke and 'dropping' dropping the hands at the finish to get the blade out. He then got them to 'drop' the blade into the water without moving the body to feel what the blade was doing. At the same time, he would be talking to them. He then made them drop the blades in the water with their 'outside' hand only. He was making general comments as the boys were doing this
	General. All
Coach	He got one boy to demonstrate this particular aspect of the stroke and got the rest to watch
	Demonstration. All

Coach	Now 'bow' side join in, using the mirror on the wall to gauge posture and hand positions.
	General. Individuals
Coach	They began and shortly after, he got 'stoke' side to join in. With all the boys rowing full stroke, he went around to each individual boy, giving them aspects of the stroke to think about. There was little discussion or questions asked by the boys, they simply rowed as they were asked to
	Observation. All
Coach	Tony then began to explain what the general problems were with the 'crew' by using the stroke man again to demonstrate the basic stroke. He then got the rest of the crew to join in.
	Demonstration. All
Coach	Again, whilst rowing, he took the opportunity to explain why posture was important and why it is crucial to get a 'clean' entry into the water with the blade. The he let them row freely, following stroke until they were comfortable. He then stopped them for a rest and prepared them for a set piece, a 5' row making them work quite hard
	Observation. All
Coach	Then he wound down for 5'. During the summing up, a couple of questions were asked
	General. All
Boy 13	How do I 'feather' my blade?
	Question. Individual
Coach	Drop the handle with your 'outside' hand and turn the blade with your 'inside' hand."
	Specific. Individual
Boy 9	How far up the 'slide' do I go?
	Question. Individual
Coach	Until your shins are vertical, keeping your head up and arms out straight.
	Specific. Scaffolding

3.3.3 Nick Ergo

Coach	All 16 are on the ergos at the same time, where Nick looks at them individually while the other 15 are practising on their own technique. Nick tends to get hands on more often in this activity. He is standing right on top of them and has the freedom to hold on to any part of the body to demonstrate the rowing stroke. This flexibility gives Nick the opportunity to coach individuals at close proximity. However, there is little discussion taking place during this session, but this slightly unusual. Nick is constantly asking questions and answering them himself, rather than allowing the individual to make comments. He begins by outlining the aims of the session and what they expect to achieve from it. He then goes around

	to individuals in crew order
	General. All
Coach	Drive back to the same place every stroke, and move your hands away at the same level from the finish. That's better, well done.
	Specific. Individual
Coach	Two, make sure you come to this point every stroke, and drive through to the finish. Can you feel the difference? You can keep this pace up for much longer now because you are more efficient.
	Specific. Individual
Coach	Well done 3, keep driving the legs to the 'finish'.
	Specific. Individual
Coach	Relax your shoulders 4, put your thumbs over the handle and keep your back straight. That's better, well done. Can you feel the difference
	Specific Individual
Boy 4	Yes.
Boy 8	Sir, are my legs pushing down quick enough to the finish?
	Question. Boy 8
Coach	Yes, but you must be careful to do it in time with the rest of your body, not leaving your arms and shoulders behind and 'bum shoving'.
	Specific. Individual
Boy 8	OK.
Coach	Nick takes hold of the handle, and follows through to the finish
	Demonstration. Individual
Coach	Now try this on your own. Can you feel the difference
	Specific. Scaffolding
Boy 8	Yes.
Coach	OK, then keep going at this pace.
	Specific. Scaffolding
Coach	Excellent 6, well done. Make sure that you continue to drive to the finish.
	Specific. Individual
Coach	Because of your improvement, we're going to do a 2K test.
	General. All
Coach	Nick then stops everyone and compliments them on their progress. At this point they all complain and groan about having to do it, but Nick reassures them that it will not be recorded; he gets them to continue
	General. All
Coach	Keep reaching out 7, well done. Come out to this point and drive back to the finish. OK?
	Specific. Individual
Boy 7	Yes.
Coach	Continue on your own now, thinking about your 'length'. That's better, well done.
	General. All
Coach	"Well done 8, good leg drive and your finish is well drawn out

	Specific. Individual
Coach	OK 9, keep reaching out, relaxing your arms and your shoulders. Draw right through to your finish and sit up. That's good, well done
	Specific. Individual
Coach	Stop. Think about what you are doing. Are you reaching out far enough? Are your arms straight and shoulders relaxed? Are you moving your hands away quick enough at the right height? Think about these technical points all the time, now continue."
	General. All
Coach	That's good, well done, much better. Can you see the difference you've made?
	Specific. Individual
Boy 9	"Yes, and I feel as though I have much more time."
Coach	Well yes, you're allowing the 'wheel' to spin much faster and getting more out of the stroke. Keep going.
	Specific. Individual
Boy 12	Sir, should I have my hands on the handle with my thumbs on the top or around it?
	Question. Boy 12
Coach	Right round, because, you need to have control of what the blade is doing.
	Specific. Individual
Boy 12	OK.
Coach	At this point, Nick gives instructions to two boys. He is standing in front of them both, getting them to reach out to him
	Specific. Scaffolding
Coach	Reach right out to me and draw right back to the finish. That's good, but you must maintain this all the time. OK, keep going."
	Specific. Scaffolding
Coach	That's good 14, well done. Are you enjoying this?
	Specific. Individual
Boy 14	Yes. I feel as though I've improved so much since last week'
Coach	Yes, you have, and I can see that you're getting a lot out of this session.
	Specific. Individual
Coach	Once Nick has seen all the boys, he stops them for a rest. He tells them how much progress has been made and that he is delighted with the effort being made. The boys now set up their machines to row 2K. This normally takes them $8\frac{1}{2}$ minutes. Nick is talking to them while they are working
	General. All
Coach	Sit up tall, don't slump over your handle at the finish, keep your shoulders relaxed. You're too tense at the moment, that's better. Feel the leg drive when you push. That's good, reach out, sitting up. Well done. Keep going. You've come a long way since last week. Well done.
	General. All
Boy 16	Thank you sir.

Coach	There is little warming up or winding down during this session, and very little demonstrating. Unusually perhaps, is the lack of question-answer teaching. This could be explained by the fact that Nick tends to feel that once the boys are on the ergos, they need to work quite hard. The ergo is seen as a training tool as well as a coaching vehicle

3.3.4 Tony Ergo

Coach	The first thing Tony did, was to sit all 16 boys down on the rowing machines. He then explained to them the usefulness of what can be achieved by training with them. He talked about rowing with good technique, with hands in the correct position, getting the legs flat at the 'finish' of the stroke, and the importance of good posture. He got all the boys to hold their handles correctly, and asked them to row with their arms only. (this is what he did on the tank). As they were rowing
	General. All
Coach	Tony then stops them and uses one boy to demonstrate the basic technique. Starting with the arms, he got them to think about the nature of the stroke
	Demonstration. All
Coach	What do notice about this stroke?
	General. All
Boy 4	A nice even draw, sir.
	Reply. Boy 4
Coach	Yes, well done. You can see that the handle is drawn easily to the body, he is not leaning back too far. It's a strong, comfortable position to be in.
	General. All
Coach	Tony now goes back to the demonstrator. He gets Tom to continue to row with arms only, talking about the importance of 'drawing' out the finish. With Tony satisfied, he asks the boys to row 50 stokes with arms only and 50 strokes with 'body swing'. At all times, Tony is talking to the boys, and helping with their technique.
	Demonstration, Observation. All
Coach	He then stops the boys, and returns to the demonstrator (Tom) to talk about the shoulder position, with the elbows drawn back. All the boys are concentrating on Tom. Tony gets him to row quarter slide, then half slide finishing off with full slide; still talking about the stroke cycle. All the boys now look at the demonstrator's stroke profile on the computer.
	Demonstration. All
Coach	The second boy is then asked to push with his legs while Tony held on to the handle, to demonstrate the importance of a good 'leg drive'
	Demonstration. Individual
Coach	Why do think you need to drop your hands at the finish?

	General Question. Coach
Boy 8	So you can get the blade out of the water cleanly and quickly.
	Reply. Boy 8
Coach	OK, but how important is that?
	General Question. Coach
Boy 6	If you didn't, you'd catch a crab.
	Reply. Boy 6
Coach	OK.
	General. All
Coach	Can you see the difference of a good strong push rather than a hard pulling of the handle? Rowing is a pushing action, not pulling, it's much more dynamic and efficient than pulling.
	General. All
Coach	Tony then asks the boys to row 20 strokes each at arms only, body swing, a quarter slide, half slide and then full. All the boys were concentrating quite hard and were very patient. Tony spent some with one particular boy, making sure that his technique was competent. Whilst Tony was with this boy, the others were discussing technique amongst themselves
	Observation. Individuals (Boy 15)
Coach	Tony sat between another two boys, watching their technique. Then one at a time, he positioned them accurately by holding them. Both boys listened carefully to the instructions
	Demonstration. Individuals (Boys 11 & 12)
Coach	Move your hands away first, follow through with your body, and then come up the slide. That's better, well done. Come right forward to me, stretch out. Can you feel the muscles working now?
	Specific. Individual
Boy 3	Yes, I can hear the wheel accelerate to the finish now too.
	Reply. Boy 3
Coach	Good. And do you feel you're rowing longer now?
	Specific. Individual
Boy 3	Yes.
Coach	Why do you think so?
	Specific. Scaffolding
Boy 3	Because, once I've got my hands away and body over, I can follow through keeping my arms straight and shins vertical.
Coach	Yes, good.
	Specific. Scaffolding
Coach	The boys were quite tired at this stage, mainly due to the intensity of their concentration. Tony gave them a ten minute rest, and summed up the session for a couple of minutes. However, they still had to a 2000metre test. This time, the score were recorded to compare with their last score. 8'17 8'19

	8'23 8'12 8'11 8'37 8'24 8'42 8'53 8'14 8'21 8'17 8'16 8'24 8'54 8'49 Tony felt that the boys made significant progress, and he was very pleased with the session.
	Observation. All

3.5.5. Nick River

Coach	All 16 boys were involved using 2 boats of eight. The crews were evenly matched and were only out on the water as part of their games afternoon. Nick their coach, started off, with a chat about the session. He talks to them about what they will be doing, how they should concentrate on listening to their coxswain and their coach and to be aware of the fast flowing conditions of the river. Once all hands were on the boat, they got boated
	General. All
Coach	Hands on, are you ready, lift, pay attention to your cox and stop talking. Swing the bows round and get the oars.
	General. All
Coach	The coxswain forgets his life jacket, but Nick gets one for him. "Bow four begin to paddle off, while stern four hold the boat steady for them. Nick has the motor boat to follow the crew. He starts coaching number 4 and works his way back to bow, (number 1)
	Observation. Individuals (within group)
Coach	Back stops bow four, are you ready, go.
	General. Individuals (4,3,2,bow) Crew 1
Coach	Four, when you get to the front, go straight in and don't rush. Hands in front of you, left in front of right, that's better, look ahead of you at all times keeping your head up. Well done, can you feel the difference?
	Specific. Individual
Boy 4	Yes.
Coach	Well Done
	Specific. Individual
Coach	Three, keep your left hand in front of your right. No! Left hand in front. Much better, well done. Looking good number two, put your blades into the water before you push with your legs. That's better, well done. You've made a big difference to the crew now.
	Specific. Individual
Coach	Bow, concentrate on your timing with stroke, draw the blades to the

	finish. Well done.
	Specific. individual
Coach	Now satisfied with the crew's progress, he gets them to stop. He then focuses his attention to the stern with bow four sitting the boat
	Observation. (stroke 7,6,5)
Coach	Stroke, keep your blades square, putting your blades in the water before pushing with your legs. Keep your hands moving around the turn. Well done..
	Specific. Individual
Coach	7, lean back a little more at the finish of the stroke, drawing your blades right through to your body, still keeping in time with stroke. That's much better, well done."
	Specific. Individual
Coach	6, keep your left hand in front of your right, and your thumbs on the end of the handles. Keep your knees together coming forward."
	Specific. Individual
Coach	Nick stops the crew to demonstrate what he means. He then moves on to number 5. Nick then stops the crew again
	Demonstration. Individual
Coach	5, keep in time with stroke, good. Don't work too hard, you can't pull the boat along on your own. Keep your hands move off the finish, holding your head up. Your timing is out again, keep concentrating.
	Specific. Individual
Boy 5	I'm not sure what you mean by hands together. Is it like this or like this?
	Question. Boy 5
Coach	Hold your hands like this, as you were doing earlier. That's better. Well done.
	Demonstration. Scaffolding
Coach	Nick then gets the crew to turn around. The crew then paddles off with all eight rowing for the first time and is looked after by another coach while he finds the other eight
	observation. All
Coach	Once he finds the other crew, he begins the whole process again, starting with bows. He spends a few minutes talking to them about general technical points and then moves them off.
	General. Crew 2
Coach	4, keep your arms straight at the catch, rowing full length, reaching forward.
	Specific. Individual
Coach	3, follow stroke, keeping in time. That's better. Well done. 2, your rowing well and your timing is spot on. Well done.
	Specific. Individual

Coach	Well done bow, excellent bit of rowing.
	Specific. Individual
Coach	Nick talks to bow four as they are rowing along, making general comments about timing, and blade heights out of the water. He then gets the crew to stop
	General. All
Boy 1	Why am I out of time so often, when I'm half-way through my stroke? The others are already out by then.
	Question. Boy 1
Coach	Come on bow it's not as bad as that. There is the occasional lapse in concentration, but generally things are going well. Just think about what is going on, OK.
	Specific. Individual
Coach	Stroke, slide right forward and drop your hands at the finish to get the blade out cleanly. Well done. Keep your blades level in the water.
	Specific. Individual
Coach	Take time and finish the stroke off. Left hand in front of right. Don't get left behind. Well done, arms straight at the catch. That's better 7, that's excellent bit of rowing going on.
	Specific. Scaffolding
Coach	6, follow seven, he's rowing really well. Push with your legs, your getting left behind a little. That's better, well done, your moving much better now, good.
	Specific. Individual
Coach	Nick lets the crew row without saying anything
	Observation. All
Coach	5, keep the buttons pushed out all the time and draw your blade right through to the finish. That way, you allow the oar to work for you and the boat becomes more stable.
	Specific. Individual
Boy 8	Why do we have to feather our blades now?
	Question. Boy 8
Coach	If the boat tips to one side, we don't get our hands caught and catch a 'crab'.
	Specific. Individual
boy 7	Can you explain how we do it again?
	question. Boy 7
Coach	Ah, you draw the blade to the finish and push down with your hands and turn with the inside hand as you are move away. That's better. Well done.
	Specific. Scaffolding
Coach	The crew then get going . The coxswain gives the instructions, but Nick stops them straight away because they all rushed forward when the coxswain said go. He started them again, making sure that they give themselves enough time to row an effective stroke. As they were

	rowing, Nick was making general comments about their technique, making sure their arms were straight at the catch, and that they were drawing through to the finish of the stroke. Once the boats were put away, Nick got them all together and discussed the outing. On the whole, Nick was pleased with the progress made, but pointed out that there was still a lot of work to be done
	General. All

3.5.6 Tony River

Coach	The sixteen boys have now been split up in fours rather than 'eights'. They are now better at rowing and they understand the technical terms used by the coaches, which gives them the opportunity to coach themselves and be more critical. Tony got all four boats on the water and paddled them off on their own for a mile or so, before stopping them for a chat. Once together, Tony made general comments about their technique and what they were going to do that outing. He sent them off in single file, coaching the crew at the back of the line. This way, the others are not washed down
	General. All
Coach	The first boat Tony looked at was probably the better crew of the four, the boys were stronger and technically better than the others. So in theory, they were the faster crew. Tony was not interested in racing them just yet, but was concerned that bad habits had not crept in to their technique
	Observation. All
Coach	Well done, you've made excellent progress recently, and I'm delighted that you're enjoying yourselves.
	General. All
Coach	Stroke, keep a nice easy rhythm going, allowing the others to follow you. The boat is less stable now, so you have to be more careful.
	Specific. Crew 1
Coach	Being a smaller boat (4 instead of 8), the boys were much more 'chatty', they were talking about their technique and what they needed to do to make improvements. Bow was telling stroke to slow down, to give him time to draw his finish in, and the coxswain was telling 3 not to work too hard. The coxswain was much more confident with his crew, since he had more control of the boat and he knew what was expected from the coach
	Observation. All
Coach	Well done stroke, that's a much better rhythm. Two, keep reaching out, keeping your arms straight at the catch and drawing through to the finish making sure you only cover the spoon and not the loom.
	Specific. Crew 1
Boy 8	Sir, should I be looking forward, or at my blade when I'm checking the

	depth?
	Question. Boy 8
Coach	Ideally, you should be able to feel the difference, so there's no reason to look around. But if you want to have a quick check, that's OK. Remember, your head is very heavy, and any movements will disrupt the balance.
	Specific. Scaffolding
Boy 8	OK sir.
Coach	This is looking good boys, well done.
	general. All
Coach	Then Tony looked at the second boat. This crew also had some good oarsmen, who were keen to develop their skill. They were all determined to do well and they had much to offer.
	Observation. Crew 2
Coach	Looking at you back there, I could see that one or two are working too hard, and 'digging' too much. You're getting caught in the water, and once out, you're blades are at different heights going up the slide to the catch. Just relax, take your time , you're not racing anyone yet, just enjoy the outing. There's plenty of time to race later in the summer.
	General. Crew 2
Boy 7	Sir, I think my foot board is loose.
Coach	OK, stop the boat and do it up.
	specific. individual
Coach	Bow, keep your hands level going forward, and your legs flat at the finish.
	Specific. Individual
Coach	All of you, hold your legs down at the finish with your buttons pressed right out. That will help to keep the boat level. That's better, nice and long, drawing through to the finish. Well done.
	General. All
Coach	After stopping the crews for a rest, Tony swapped their positions so he could coach the next boat. By now, the crews had rowed 2 to 3 miles and were well into their outing.
	Observation. All
Coach	OK coxswain, off you go.
	General. Coxwains
Coach	The crews paddled off and there were a few problems with the blade heights, so Tony stopped the crew
	Observation. All
Coach	OK, you all need to think about your blade work and your hands at the finish. Keep your legs held down and your buttons pressed out against your gate, that way you keep the boat level. Once at the finish you drop your hands and move them away before feathering them. You must all

	do this together.
	General. All
Coach	The crews started off again, and Tony kept encouraging them. The coxswain was very busy, giving instructions and the crew responded well to him
	General. All
Coach	That's better everyone. Good. Bow, keep moving your hands away, well done.
	General. All
Coach	Tony kept the crew rowing for another 5 minutes and then stopped them, changing the boat order once again. This boat contained one or two weaker oarsmen, who required a little more assistance than the previous boats. Alexander, the boy at 2, had difficulty keeping up with the others in the boat, which annoyed the other three boys. Frustration was becoming more obvious as the outing progressed. Putting him at 2 was perhaps the best place for him, because he had least responsibility and his actions were less disruptive
	Observation. All
Coach	OK coxswain, paddle off, making sure the crew is set up. Remember all of you, you must stay in time , keeping long and drawing through to the finish.
	General. All
Coach	As the crew paddled off, Tony kept an eye on them and he made the odd general comment about timing. It was interesting that by now, the crews were coaching themselves, the coxswain was taking more and more control and instructing the crew accordingly. All the boys were in a much stronger position to discuss their faults and difficulties and were able to sort many of them between themselves. This aspect of self-coaching is crucial to the development of the crews. The coach could only be with one boat at a time so as not to 'wash' the other boats down and disrupt their water
	Observation. All
Coach	Tony stopped all the boats and gave them a rest. He then wanted to race the crews back to the boat house. The boys were clearly excited by this, but Tony new he had to stagger the start to allow the slower boats a chance of getting to the finish first. Boat 4 went off first (with Alex on board) followed by boat 3, then boat 2 and finally boat 1. The race would last about 10 minutes (going with the stream).
	Observation. All
Coach	Are you alright Alex?
	Specific. Individual
Boy 6	Yes sir.
Coach	OK, first crew go, and remember to stay in time.
	General. Crew 4
Coach	The boats moved off and Tony watched carefully. It was good to see

	how each crew had responded to the challenge and how the coxswains' steered their boats. Boat 4 was clearly the quickest, it had the strongest and technically the best oarsmen. There were no surprises there. Once the crews had had finished and their boats put away, they gathered round for a quick chat. Tony was very pleased with everyone and assured them that they would be racing in the summer. This lasted for 10 minutes. There were one or two questions from the boys, asking about how they should race and what kit to wear
	Observation. All

3.5.7 Appendix C

BASIC STROKE

PRE-TEST

Recovery		Catch		Drive		Release	
Sal	Jo	Sal	Jo	Sal	Jo	Sal	Jo
2	3	2	3	1	2	3	3
2	3	3	4	2	3	2	3
1	2	2	3	3	4	2	4
2	3	3	4	4	3	2	3
2	3	3	4	4	4	2	4
1	2	4	4	4	5	3	5
2	3	4	5	4	4	2	3
2	4	5	6	3	5	3	4
3	4	5	5	3	5	3	3
2	3	3	4	4	5	3	4
2	3	4	5	5	6	3	4
3	4	3	4	4	5	3	4

Post-Test

Recovery		Catch		Drive		Release	
Sal	Jo	Sal	Jo	Sal	Jo	Sal	Jo
4	6	4	5	4	4	5	7
3	5	5	5	3	4	4	5
3	5	4	5	7	6	4	6
3	4	4	5	5	7	4	5
3	5	5	7	5	7	5	6
3	4	6	6	7	7	4	5
3	5	7	8	5	6	5	6
3	5	6	6	6	6	6	6
5	7	7	8	7	7	5	6
4	6	6	8	8	7	6	8
4	5	6	7	6	7	5	5
4	4	6	7	7	8	5	6

Sal

Recovery		Catch		Drive		Release	
Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Pro-Test
2	4	2	4	1	4	3	5
2	3	3	5	2	3	2	4
1	3	2	4	3	7	2	4
2	3	3	4	4	5	2	4
2	3	3	5	4	6	2	5
1	3	4	6	4	7	3	4
2	3	4	7	4	5	2	5
2	3	5	6	3	6	3	6
3	5	5	7	3	7	3	5
2	4	3	6	4	8	3	6
2	4	4	6	5	6	3	5
3	4	3	6	4	7	3	5

Pre-post test scores for each element of the stroke: study one

3.5.8 Appendix D

Pre-Test & Post-Test Results

Pre-Test Mean	St.Dev	Post-Test Mean	St.Dev	T-Test	
2	0.577	3.5		0.645	9.95
3.417	0.954	5.5		1.041	10.79
3.417	1.037	5.833		1.404	6.384
2.583	0.493	4.833		0.687	12.54

3.5.9
Appendix E

Boys	Level 1	Level 2	Level 3	Level 4	Nos of Interventions	% R of S
1	2	3	7	2	14	50
2	2	3	5	1	11	72.7
3	2	3	5	1	11	81.8
4	2	3	5	1	11	57.1
5	1	2	4	1	8	75
6	3	4	6	2	13	69.2
7	2	2	4	1	9	66.7
8	2	3	5	1	11	63.6
9	2	3	7	2	14	64.3
10	3	4	6	2	15	60
11	4	6	8	3	21	71.4
12	3	3	5	2	13	46.2
13	2	3	5	1	11	54.5
14	2	3	5	1	11	54.5
15	2	3	5	2	12	58.3
16	2	3	5	2	12	66.7

Leve1 = General verbal encouragement
Level 2= Specific Instructions
Level 3 = Hands on
Level 4 = Demonstration

Boat Rowing on the Water

Boys	Level 1	Level 2	Level 3	Level 4	Nos of Interventions	% Rof S
1	5	9	0	1	15	40
2	5	10	0	1	16	43.8
3	5	2	0	1	17	35.3
4	5	10	0	1	15	46.7
5	5	8	0	1	14	42.9
6	6	8	0	1	14	35.7
7	5	7	0	1	13	38.5
8	5	8	0	1	13	46.2
9	6	7	0	1	13	38.5
10	6	8	0	0	14	42.9
11	6	8	0	3	17	41.2
12	6	7	0	0	13	38.5
13	5	7	0	1	13	30.8
14	5	7	0	1	13	38.5
15	5	8	0	0	13	46.2
16	5	7	0	1	13	53.8

Tank Session

Boys	Level 1	Level 2	Level 3	Level 4	Nos. of Interventions	% R of S
1	2	3	4	1	10	70
2	2	4	5	2	13	53.8
3	2	3	4	2	11	54.5
4	1	2	3	1	7	71.4
5	2	3	5	2	12	58.3
6	3	5	6	2	16	56.3
7	2	3	4	1	10	60
8	2	3	4	1	10	60
9	2	3	4	1	10	70
10	3	3	4	1	11	63.6
11	4	5	7	3	19	73.6
12	2	3	4	1	10	60
13	2	3	4	1	10	50
14	2	3	5	2	12	58.3
15	2	3	4	1	10	70
16	3	4	5	2	14	57.1

Pre-Test	Post-Test
3	1
4	2
3	1
4	2
4	1
4	2
4	2
4	1
4	2
4	2
4	3
3	1
4	1
4	2
4	1
4	2

Pre-post test for study two

Pre- to Post-test Difference Catch	Pre- to Post-test Difference Drive	Pre- to Post-test Difference Release	Pre- to Post-test Difference Recovery
2	2	1	1
3	4	2	2
2	3	4	2
2	4	4	3
1	1	2	2
1	3	1	2
2	2	3	4
2	2	3	3
3	4	3	3
3	3	3	4
1	0	0	0
2	2	3	3
2	2	3	2
2	2	3	4
2	2	2	2
2	3	3	2

Pre-post test score for each stroke: Study Two